

SCIENCE.

FRIDAY, MARCH 18, 1887.

COMMENT AND CRITICISM.

THE SIXTH CONGRESS of the Société nationale des professeurs de Français en Angleterre, held at London in January, attracted considerable attention from educators generally, and principally, it seems, from the very instructive address with which Dr. Jowett welcomed the members of the congress to Oxford for one of their sessions. The honored professor of Greek at Balliol assured the visitors that the ancient and modern languages have no quarrel, but rather they are related as parents and children, and the greatest affection should exist between them. In particular, he continued, no Englishman can be indifferent to the excellence of Bossuet and Fénelon, Montesquieu and Turgot, Voltaire and Rousseau, Montaigne and Pascal, or insensible of the great debt owed to these men by the English language and literature. It must be remembered, too, that above all other European languages, in French had been developed the noble and enviable quality of lucidity of style. Dr. Jowett then confessed that the treating of the modern languages in England was capable of great improvement. The first step in this improvement must be the following of a natural method. What this is, Dr. Jowett immediately specified: "Nature teaches us to begin with the ear, and not with the eye; with association, and not with analysis; with imitation, not with abstractions; with conversation, not with books of exercises. The powers of the mind generally strengthen, at least to middle life; but the faculty of learning languages decays, and is almost in inverse ratio to one's years. It is stronger before than after ten, stronger at twenty than at thirty, and so on." Furthermore, nature teaches us that a task should be proportioned to the capacity of the learner; and therefore instruction in the modern languages, which are the easier, should precede that in the classics. The speaker also commented severely on the too great time now spent in acquiring a very moderate knowledge of the classics, and called for a 'reform of procedure.'

No. 215 — 1887.

Sufficient emphasis, continued Dr. Jowett, is not laid upon an acquaintance with modern languages. The universities still guide to a very large extent the education of the country, and they have heretofore given slight encouragement to the study of French and German. While the universities neglect these studies, they will be neglected at the schools and undervalued in the homes. He then made a suggestion which we have supported on several occasions already; namely, that a reasonable knowledge of some modern language may fairly be demanded of every university student, but — and here we must differ even from so distinguished an educator as the master of Balliol — for his degree, not for admission. We are not so sure that it is altogether fair to say that no one but a native can impart "the accent, the intonation, the true living voice of a language." Dr. Jowett said this, and of course his guests did not disagree with him. But it seems to us to go too far. Under this dictum, Max Müller would be prohibited from teaching English, and Mr. Saintsbury from teaching French. Before concluding their session, the French masters passed a formal resolution, asking for the establishment at Oxford of a school of modern languages, in order to encourage the study of French literature, and of the French language as a living tongue.

FOR THE BENEFIT of those who are fond of impressing on us continually the great advantages to be gained from a thorough and detailed system of methods, we would call attention to the book of instructions which has lately been issued in Austria, for the use of the teachers in the *realschulen*. The French system has always been supposed to be the most highly organized possible, but Austria is a dangerous competitor for the honor. It is Mr. Matthew Arnold, it will be remembered, who tells the story of the French minister of education who pulled out his watch and exclaimed that at that instant all the children of France were receiving instruction on the same subject. The same thing may hereafter occur in Austria; for, as the Vienna correspondent of an English journal remarks, "the Austrian teacher who, in his geog-

raphy-lessons, is treating the Caucasus, will no doubt be cheered by the reflection that at the same moment all the geography-teachers in the empire are treating the Caucasus, and, like himself, are calling attention to the points of similarity between the Caucasus and the Pyrenees, the straightness of the two mountain-ridges, the low plain to the north of each, the small number of passes in each, and the reach of both from sea to sea." For all this is laid down in the big book of instructions. Moreover, the teacher's expression of countenance must be professional, and not the index of his feelings; for the regulations expressly provide that "a teacher, on crossing the threshold of the school, must exhibit a cheerful and contented countenance, to show that he has his work at heart." We cannot imagine any thing much more nonsensical or degrading to the teaching profession than this. We believe, as much as any sensible educator does, in organization and method; but, when it is allowed to proceed to such lengths as the above instances indicate, it is high time to call a halt. Method gone mad is worse than no method at all.

PROF. WILLIAM JAMES is certainly the pleasantest and clearest writer we have in this country on psychological topics. His short articles, while never difficult reading, are always worth reading, both from the popular and the scientific standpoint. His latest paper, on 'What is an instinct?' in *Scribner's magazine*, is an excellent example of this. In style and form it closely resembles the same writer's recent paper on habits, to which we called attention at the time of its publication. In each a psychological study is concluded by a pedagogical rule of practice. As in the previous paper Professor James pointed out the importance to the teacher of a knowledge of the psychology of habits, so here he says that "to detect the moment of the instinctive readiness for the subject is, then, the first duty of every educator. As for the pupils, it would probably lead to a more earnest temper on the part of college students if they had less belief in their unlimited future intellectual potentialities, and could be brought to realize that whatever physics and political economy and philosophy they are now acquiring, are, for better or worse, the physics and political economy and philosophy that will have to serve them to the end." Professor James accepts the definition that instinct is the faculty of acting in such a way as to produce certain ends,

without foresight of the ends, and without previous education in the performance. This is slightly less specific than Mr. Romanes' definition, which is, that instinct is a generic term, comprising all those faculties of mind which are concerned in conscious and adaptive action, antecedent to individual experience, without necessary knowledge of the relation between means employed and end attained, but similarly performed under similar and frequently recurring circumstances by all the individuals of the same species.

Professor James prefers to subsume instinctive under reflex actions, though we think Prof. Lloyd Morgan's criticism on so doing deserves consideration. Professor Morgan, with Mr. Romanes, defines reflex action as non-mental, neuro-muscular adjustment, due to the inherited mechanism of the nervous system, which is formed to respond to particular and oft-recurring stimuli, by giving rise to particular movements of an adaptive but not of an intentional kind. He then asks whether it will not be better to avoid introducing the term 'reflex action' into the definition of instinct, inasmuch as a reflex action is a direct response to a definite stimulus, and puts the specific question, Can we call all instincts, for example the migratory instincts of birds, reflex actions? Professor James sees clearly that the answer to such a question as this must rest upon the extension permitted to the term 'instinct,' and he himself confines instinct to impulses to act resulting from present sensations. The writer also makes good use of Schneider's 'Der thierische Wille,' but is specially happy in his demonstration of the way in which two scientific principles — the inhibition of instincts by habits and the transitoriness of instincts — account for what Mr. Romanes has called 'derangements of the mental constitution.' The paper is a most excellent combination of the scientific and the popular, and we heartily commend it to all intelligent readers.

IN THE LONDON *Journal of education* for February, the Rev. R. H. Quick has an article on 'Dr. Paulsen and the curriculum of the future,' which contains the surprising statement that the writer — and Dr. Quick is one of England's best informed educators and educational writers — had not seen or heard any mention in England of Dr. Paulsen's 'History of the higher instruction in Germany.' He then proceeds to paraphrase the major portion

of Dr. Paulsen's concluding chapter, and to apply its sentiments to the discussion as to the nature of the curriculum of the future. We are several thousand miles farther from Berlin than our English co-workers, yet Dr. Paulsen's name and thought are well known here. In fact, the *Academy* published recently, in the form of a supplement, a complete and very excellent translation of Dr. Paulsen's now celebrated final chapter. We cannot understand the English ignorance of Paulsen's work and status, unless that people fails to read all educational literature published off the Island of Albion, which is an opinion we shall be very sorry to hold. Professor Paulsen is one of the most popular professors in the Berlin faculty, and he lectures to large audiences of students. He is also a councillor of state for education and one of the state board of examiners of the candidates for licenses to teach, and has in a variety of ways exercised a wide influence on Prussian education. His philosophical writings are of a very high order, and he is surpassed by no one in his critical mastery of the history and philosophy of education.

THE DOUBLE NUMBER of the *Library journal*, bearing the date January and February, will be very valuable for future reference because of the tables it contains concerning the libraries of the United States. The statistics are taken in the first instance from advance sheets of the forthcoming report of the bureau of education, and an addition is made of the names of the librarians and a classification of the libraries according to size. The government list comprises all libraries having 300 volumes or over, and contains 5,338. The *Library journal*, however, only reprints the information concerning those of 1,000 volumes or over, and these number 2,981. Forty-seven of these have over 50,000 volumes; and among the forty-seven are the public libraries of Boston, Chicago, and Cincinnati, and the libraries of Harvard, Columbia, Yale, Cornell, and Brown universities. These forty-seven libraries aggregate 5,026,472 volumes; and the whole list of 5,338 libraries aggregates 20,622,076 volumes, or one volume to every three persons in the country. In round numbers, the United States has one library to every ten thousand of population, though in many states the proportion is far greater. New Hampshire, for example, has a library to every 2,700 persons. The neighboring states of Massa-

chusetts and Connecticut furnish a library to every 3,134 and 3,479 persons respectively. California, Colorado, Wyoming, and Michigan stand well up on the list. The southern states, as might be expected, make the worst showing, Arkansas bringing up the rear with one library to every 50,158 of population.

A TENDENCY is observable on the part of many young teachers, whose enthusiasm and imagination are roused by the great discoveries of modern science, to substitute in their instruction the method of discovery for the method of exposition. Excepting for advanced students, in university courses and the like, the substitution is rather confusing than beneficial. The young child cannot rise to an appreciation of the relations between isolated facts save as these are used in illustration of a principle. There must be some support on which to hang the facts in question, if the child is to grasp their significance. For this reason we believe that there is a stage in education when it is preferable to state a simple principle, and then illustrate it fully, than to present the pupil with a congeries of facts with the request that he ascertain their relations and causal dependence. Yet a great many young and well-instructed — save in pedagogics — teachers, understanding themselves the value and purposes of the method of investigation, demand of their pupils what the latter are not able to give. The fact should be recognized that the method of exposition has a determined place in education, and should be awarded it.

DR. LUCY M. HALL, physician to Vassar college, in a short paper in the *Popular science monthly*, brings to the discussion concerning the higher education of women inaugurated by Dr. Withers-Moore — to which we have alluded several times already — some conclusions deduced from statistics gathered by herself concerning the number of children born to women who have pursued a course of higher education. The statistics were gathered for the purpose of measuring the great falling-off in numbers in the American family, and, though by no means complete, they bear directly upon the question at issue. The data were taken from all grades of American life save that found in extreme poverty. The women were, as a rule, simply educated. A few were more highly educated, and the figures show that the largest families of the present generation belong to the

most highly educated of the women. One hundred and seventy-five families give an average of 3.2 children to each. Of the few really large families, the evidence shows the mothers to have been in most cases well educated, and in a few cases exceptionally so. Dr. Hall's own experience has been, that young women in college are unusually healthy, and become increasingly so as the course progresses. She quotes President Bascom, of the University of Wisconsin, as saying, "The young women do not seem to deteriorate with us in health, but quite the opposite. . . . It has long seemed to me plain that a young woman who withdraws herself from society and gives herself judiciously to a college course is far better circumstanced in reference to health than the great majority of her sex."

*GENERAL PSYCHOLOGY, ITS DEFINITION,
LIMITS, AND METHOD.*¹

I.

It is necessary at the commencement of this treatise, not to define, — for that is almost impossible, — but to explain, the meaning of the term 'general psychology.' In fact, until now the term has been very rarely used; and in all scientific literature there is no work, so far as our knowledge extends, that bears this title.

Psychology, as ordinarily understood, is the science of intelligence: thus all depends upon the extension given to the word 'intelligence.' Taken etymologically only, intelligence signifies the comprehension of things, or the knowledge of the causes of action; but taken thus, the term is too narrow, for it follows that there is no intelligence save in connection with a self-conscious being. An unconscious intelligence would be, viewed etymologically, a meaningless phrase, since to comprehend a thing would imply, by definition, the consciousness of the comprehension. But the instances of unconscious intelligence, absurd though the expression is, are certainly many and convincing. Take, for example, the ordinary occurrence of the solution of a problem during sleep, though he who solves the problem is in total ignorance of it. Can it be denied that an intellectual process is here involved? We must, then, admit that there are intellectual phenomena which are unconscious or nearly so; and therefore psychology cannot be limited to the study of self-conscious intelligences. The chief difficulty here is in the language, since no other term except the inaccurate one, 'intelligence,' can be ap-

plied to this unconscious mental activity. The expression 'psychical activity' is indeed better, though somewhat pedantic. Perhaps it would be more fitting to use the word 'ideation,' leaving to the term 'intelligence' its precise, clear, and evident meaning; namely, the conscious comprehension of things. I, for my part, prefer to give the term 'psychology' an application wider even than unconscious ideation and conscious intelligence: for there are numerous beings which perform complicated acts that are called instinctive, in which no intelligence, whether conscious or unconscious, is involved. Can it be said that psychology takes no notice of instinct? Surely its exclusion would be permitted by no one. Instinct is a psychic force, intelligent as to the end in view, if not as to the means employed. This is sufficient to give it a place in general psychology.

Even if the act performed is not understood by the agent, it is nevertheless perfectly adapted to its end. Thus a vague and latent intelligence, of which we cannot deny the existence, is manifested. Moreover, we can trace all the gradations, in a clearly defined hierarchy, from blind instinct to wholly conscious intelligence. There are, then, diverse psychic forces, — instinct or latent intelligence; ideation or unconscious intelligence; and, finally, intelligence properly so called, that is, conscious intelligence.

But what are the sources of instinct? Whence does it arise? We do not fear to go on to such consequences as general psychology may point out. Just as the zoölogists and embryologists assign to beings, however diverse, the humble origin of a primary cell, so we may trace all psychic forces, instinctive and intelligent, to their humble origin in an elementary reflex action. Instinct is not always so complicated, as it is usual to suppose, when the term is employed without qualification. Unquestionably the instinct of the mother who bends lovingly over the cradle of her child, that of the bee that builds its hexagonal cell, and that of the insect which poisons the body of its victim behind the second cephalic ring, constitute complex intellectual operations, of which the psychological character is undeniable. But how often is instinct more simple and rudimentary?

Let us take an instance which is of historic interest; for it was by this example that Descartes first gave us, with remarkable precision, the theory of reflex action. Here is a heated object: if the hand touch it, it is immediately withdrawn. Is this instinct, is it reflex action, or is it an act of intelligence? Here is an act which at the same time combines the characteristics of all three classes of phenomena. It is an act of intelligence,

¹ Translated for this journal from the author's forthcoming work, entitled '*Essai de psychologie générale*.'

because consciousness, and consequently will, are involved; it is instinctive, because it is an instinct necessary to the preservation of life, and common to all beings, to avoid a contact which gives rise to pain; finally, it is reflex, for it is not determined by the will, and the withdrawal of the hand is effected before the resolve to withdraw it is made. Here, then, is an elementary reflex act which is at the same time intelligent and instinctive. Among the lower animals many instinctive movements are nothing but reflex actions. A limpet clings to its rock: it is but slightly fastened, and moves but slowly over the surface of the stone. But touch its shell, and attempt to lift it, and instantly it fastens itself firmly to the rock; and to detach it a very great expenditure of effort is necessary. Its firm adhesion to the stone has been instinctive, suddenly and resistlessly determined by contact with the aggressor. It is a reflex action, but instinct is also involved.

It is truly impossible to say just where instinct begins and reflex action ends. The two phenomena intermingle, and instinct should be regarded as a complicated reflex action.

'Intelligence,' 'instinct,' 'reflex action,' — these are the three terms of psychology. Between these three forms of activity there is no barrier, no hiatus, no abyss. The gradation is regular and without leap. And why should it not be so? Where in nature can sudden transitions, the existence of which was denied even by Aristotle, be found? Sudden appearances of a new phenomenon are not known. Between the man and the animal there is hardly any distinction. There is hardly any between the animal and the plant, and the beginnings of psychology are in the beginnings of life itself. It would be a useless task to attempt to limit psychology to the phenomena of instinct or of intelligence. Psychology commences with reflex action; so that its domain includes elementary reflex action, the movement by which the limpet clings closer to the rock, as well as the most complicated intellectual operation, for instance, the discussion of the Abelian functions. In what follows we shall see how, by successive steps, psychical action frees itself little by little from the elementary reflex phenomenon. Our aim has been to take the psychic phenomenon at its origin, however humble that may be, and to follow it in its progress through the uninterrupted series of living beings.

II.

It is this synthetic treatment that seems to us to merit the title of 'general psychology.'

The term is rarely used; but we believe that it deserves to take its place among the sciences. We

speak of general physiology, and the term is perfectly definite. The same should be true of general psychology. Chemistry is the science that treats of the molecular transformation of matter. According to the stand-point that is taken, we have a chemistry without any particular designation, treating of all the divisions of chemistry, or we have mineral chemistry, organic chemistry, physiological chemistry, industrial chemistry, analytical chemistry. But there is also a general chemistry, which passes over in silence both the particular facts, the details of which are without number, as well as their applications and the technique built upon them, while only the general laws of chemistry are discussed. The special subject of general chemistry is the totality of the molecular transformations of matter, — the theory of atoms, their affinities and classifications, the equivalence of forces, and so forth. Physiology, or the science of life, can also be studied from diverse points of view. We have physiology without any particular designation, which comprehends all the subdivisions of the science; human physiology, which studies specially the vital phenomena of man and the higher animals; comparative physiology, which treats of the vital functions of all animals in comparing the life of all beings from the lowest of animal forms to man, which is the highest development; vegetable physiology, which treats of the vital functions of plants; pathological physiology, which has to do with the functions of life as modified by disease; and, finally, general physiology, of which life in general forms the subject-matter. Details are passed over in silence, for they are due to special conditions which are almost invariably peculiar to some group of animals or other.

Such is the *raison d'être* of general physiology. It is the synthesis of all physiology, but of physiology apart from the myriad of details which encumber it, and set forth only in its main outlines and in its most general laws. While the classic works of physiology develop the complexity, which is almost infinite, of the vital function, general physiology presents us the picture of the grand unity of life as it is manifested, under forms so extremely diverse, on the surface of the earth.

Psychology, like physiology, falls into several very distinct divisions. There is a psychology without designation, which treats of psychology in its entirety and under all its phases; also a human psychology, limited to the study of the intelligence of man; also a comparative psychology, by which are analyzed the phenomena of intelligence exhibited by animals and allied to those manifested by man himself; a pathological

psychology, which describes and explains the modifications of the human intelligence caused by disease; and, finally, a general psychology, which, without taking up all the details of its subject-matter with their analyses and comparisons, strives to bring to a focus the facts of which the details are numberless. In a word, general psychology attempts to form a synthesis, profiting by the analyses made by human and comparative psychology.

For general psychology, as for general physiology, but one method is possible, — the experimental. And as to this, a short explanation is essential, in order that a confusion too frequently made may be avoided. As a matter of fact, an opinion, very easy of refutation, is frequently attributed to the defenders of experimental psychology. They are said to admit nothing but experience, and to deny the validity of introspection or the internal sense. But, on the contrary, no physiologist has ever thought of setting aside the subjective observation of the elements of knowledge. How can we study the effects of memory or of imagination, unless we observe ourselves? Who is the physiologist or naturalist that upholds this opinion? and why combat it, when no one defends it? Internal observation gives us a psychology based on experience which is quite as legitimate and quite as fruitful as the most thoroughly experimental physiology can be imagined to be. The facts gained from the study of the *ego* are quite as valuable, provided they have been observed carefully and methodically, as the physiological phenomena recorded in the laboratories by the most perfect methods that our modern technique has devised.

But, however important this internal observation may be when it addresses itself to consciousness, it can be applied to but a single object, the knowledge of the *ego*. Beyond this it is dangerous and sterile. In is not internal observation which tells us how the stars move, and what the properties of matter may be. It knows and studies the *ego*. It observes itself, it judges itself, but it is forbidden to leave this domain of the *ego*, — a domain so vast that numberless discoveries are yet to be made in it, and yet so narrow that the *ego's* unsatisfied curiosity urges it eagerly beyond it. But here science alone, with its rigorous methods, its accurate apparatus, and its exact measurements, can make a progress which is slow but sure. In a word, introspection can only hope to know the facts of consciousness. The general properties of organic matter, whether it be inert or endowed with thought, remain for it unknown. They fall within the province of physics, chem-

istry, and physiology. Introspection can only judge phenomena.

But this is common to all the sciences. Nevertheless it applies particularly to psychology, which proceeds by introspection carried on with great care. For psychology cannot experiment: it can only observe. And it is well known that sciences founded upon observation are not so rich as are sciences of experiment, in conclusions of various and far-reaching import. Under all circumstances we are forbidden to ratiocinate, that is to say, to construct systems of metaphysics and of transcendental physics. That which psychology can do, and which it alone can do, is to observe the phenomena of consciousness. Beyond that, it is but an illusion.

Thus general psychology, aided now by introspection, now by the study of organic beings, now by experiment, extends from the lowest animal all the way up to man. But is this its whole sphere? For our part, we do not hesitate to say yes; for, if there should exist in nature intelligences or conscious powers analogous to those of man, they have not yet been revealed to us. Assuredly it would be absurd to suppose that this earth alone, among all the infinity of worlds, is the only portion of space where intelligent beings exist. The very fact that men exist on the earth renders it extremely probable that life has appeared on other stars also, and that there exist there intelligences similar to ours. The chemical composition of the stars is almost the same as that of our planet, and consequently the same phenomena ought to be manifest there as here. But our feeble science cannot go so far. We are limited to a terrestrial psychology, which is probably the only one of which man can ever know any thing. Though thus restricted to the animal world and to the consciousness of the *ego*, general psychology, presenting facts in their totality and not in detail, is not only a science of immense scope, but the most attractive of all the departments of human knowledge.

CHARLES RICHET.

GEOGRAPHICAL NOTES.

Europe.

Some more detailed news of the Riviera earthquake of Feb. 23 has been received. The facts, so far as they are of scientific interest, are summed up by Father Denza of the Montcalieri observatory. He states that the shaken area extended to the east along a line leaving the plains of Lombardy at Lomellina, and passing by the district of Alessandria to the Riviera di Levante, and westward, over all the western Alps, proceeding to-

wards Switzerland as far as Geneva and beyond, and to Paris and Corsica. The centre of greatest intensity was in the Gulf of Genoa, along a line dividing the place where the Apennines join the Alps, and extending from Savona to Mentone. The earthquake spread over the valley of the Bormida, and did considerable damage in a portion of the province of Cuneo, as also in the provinces of Alessandria and Turin, it being very intense on Mont Cenis. It was slighter on the plains and in the valley of the province of Novara. In the places where the earthquake was most intense the principal shocks were three in number, and with a slight difference, depending probably on the difference of clocks, correspond to the times indicated by the seismic instruments at Montcalieri; namely, the first at 6.22 A.M., the second at 6.31, and the third at 8.53. In the places near the centre of motion slight shocks occurred at intervals all through the day. The severest and most terrible shock was the first, which was undulatory in several places, oscillatory, and perhaps rotatory. It was several times prolonged and accentuated. At Montcalieri, as well as at Turin and elsewhere, it had three principal repetitions, plainly evidenced by the courses traced by the registering seismograph. These augmentations of intensity were mistakenly regarded by some as so many distinct shocks. The dominant direction of the first undulatory shock was from west to east, with slight deviations at intervals from west and north-west to east and south-east, and with oscillatory and very slight vibrations. The two other shocks were also undulatory, and the last was rather more intense than the second, but without reaching the intensity of the first. The second and third had about the same direction as the first. The earthquake, in places where it was very severe, was accompanied by rumblings. It will be remembered that slight shocks continued during the following days. These have occurred at intervals since, the latest being reported on March 11. At Mentone and Porto Maurizio these shocks were the most violent ones since Feb. 23.

A scientific and industrial exhibition will be opened at Ekaterineburg in May next. The mining industries of the Ural Mountains will be well represented. Special interest will attach to the department of ethnography, as it has been arranged that there shall be in the exhibition a number of families belonging to the native tribes of the Ural Mountains and Siberia. Their dwellings will be exactly like those in which they usually live, and they will have with them the weapons and implements used by them in hunting and fishing. Another important element will be a collection of ancient objects in stone, bone, clay, and

metal, found in Siberia and among the Ural Mountains. These objects have never before been publicly exhibited.

Oxford has agreed, in answer to the representations of the Royal geographical society, to found a readership in geography, bearing all the expense thereof. Cambridge has determined to take a similar step, the geographical society paying half the stipend of the lecturer.

Asia.

The Russian traveller M. Ogorodnikoff was told at Meshed that there are tin-mines near that city and in various parts of Khorassan. In an article in the *Revue scientifique*, M. Berthelot points out that this accords with a passage in Strabo, who speaks (book xv. ch. ii. 10) of tin-mines in Drangiana, the ancient name for the region now called southern Khorassan. If there really have been tin-mines in this district from time immemorial, there can be little doubt that they supplied the tin for the bronzes of ancient Egypt and Assyria.

Krasnof, who was sent out by the Russian geographical society to explore the Khan-tegri, finished his exploration of the Balkash region, and went to Kara-Kul last summer, where he intended to join his companion, I. V. Ignatief. He reports that the river Kara-Soo, which is indicated in the maps, does not exist. He found only a small water-course called Kara-Sai, which is dry at all seasons. All the rivers coming from the mountains of At-lesken are long since dried up. The Ala-Kul has so little water that the Kirghis have been able to cross it on horseback ever since about five years ago, the horses having to swim only fifty yards. In spring the rivers are higher. The water of the west side of the lake is fresh, that of the central part brackish, and in the northern parts it deposits salt. The desert can easily be crossed in all directions, the Kirghis knowing many routes; and, particularly in summer, water may be met with about every forty miles. The river Ili is probably being deflected eastward. The water is stagnant in the beds of its delta, and no floods have occurred in its tributaries during the past three years, while the quantity of water in the Kurlu seems to be increasing. The district of Kaman abounds in woods and reeds. The Kirghis used to cultivate rice here. At the present time wheat is cultivated only in several districts of the desiccated lakes, which require no irrigation. In the Khan-tegri, Krasnof and Ignatief discovered an enormous glacier. When about to cross the frontier of China, they were sent back, as the Chinese authorities were not notified of their intention to visit Chinese territory.

Africa.

The Mongalla, one of the northern tributaries of the Kongo, the lower part of which may be seen on the sketch-map contained in the last issue of *Science*, has been explored by Lieut. E. Baert, who ascended it on the small steamer belonging to the station of Bangallas. He followed its course for two hundred and twenty miles, when his progress was stopped by rapids. Its course is very meandering, similar to that of the Biverre. The country around the river is hilly, and inhabited by the Sebi, who are, like other tribes of central Africa, very good blacksmiths. The rapids of the river are in latitude $3^{\circ} 30' N.$, and longitude $22^{\circ} W.$ If this position be correct, Junker's Ali-Kobo will probably be a little farther north. The direction of the Mongalla is north-east and south-west: its valley is densely wooded.

Lieutenant Webster, late commander of the station of Stanley Falls, has returned to Brussels, and gives a description of the Mburu, the eastern tributary of the Kongo emptying near Stanley Falls. He ascended the river for two days in a canoe. At the mouth it is about 1,100 feet wide. On the northern side, a little above the mouth, it has a tributary called 'Lindi,' which comes from the north-west and is about six hundred feet wide. The main river is called by the natives 'Anki-ambo.' It seems to come from the east. At the farthest point reached by Webster it is eight hundred feet wide. In two places there are rapids. The country is wooded and abounds in elephants. It is inhabited by the Wabeda, who have villages of two or three thousand inhabitants on the middle part of the Mburu.

According to a telegram published in the *Mouvement géographique*, Tippo-Tip has declared his submission to the Kongo Free State, and expressed his regret as to the attack on the station of Stanley Falls which occurred during his absence. As he has a great influence in central Africa, his submission will probably lead to the re-establishment of the stations on the upper Kongo.

The Stanley expedition for the relief of Emin Pasha, which left Zanzibar about three weeks ago, arrived at Cape Town on March 9, and proceeded for the Kongo the next day.

News has been received from Emin Pasha to the effect that in November last he went to Uganda, and that King Mwanga refused to permit him to go through the country. Then Emin Pasha tried to effect a passage out through Karagwe, on the western shore of Lake Nyanza. In this he also failed. He then returned to Wadelai, leaving a detachment of soldiers at Unyoro under the command of Casati, his sole European companion.

America.

The missionary E. I. Peck has succeeded in crossing Labrador from west to east. In the winter of 1882, in the summer of 1883, and in the winter of the same year, he failed in his endeavors to reach Fort Chimo in Ungava Bay. In 1884 he started from his station on Little Whale River on July 17, and reached Fort Chimo on Aug. 11. He travelled by boat on the numerous lakes and rivers of the peninsula, and while crossing Clear Water and Seal lakes. The numerous watersheds and rapids of the rivers he passed by making portages. From his journal, which has been published by the *Church missionary intelligencer* in 1886 (p. 510), it appears that the maps are unreliable; but he has not made any observations which would enable us to correct the errors of the maps. The geography of this district is still very little known. It is even doubtful whether the western half of Labrador belongs to the mainland, as, according to some reports, there exists a connection between Mosquito Bay on the east coast of Hudson Bay, and Hope Advance Bay in Ungava Bay.

In the *American naturalist* for January, 1887, Mr. John Murdoch publishes a paper on some popular errors in regard to the Eskimos. He points out that there is no evidence of polyandry among this people; that they do not live in underground dens, keeping up their internal heat by enormous meals of raw blubber washed down with draughts of lamp-oil; and that they are not at all of dwarfish stature. Though we concur with the main points of the author's opinions, we wish to add a few remarks. Murdoch quotes Graah as the only reliable authority who knew by report that the East Greenlanders practised polyandry. The best authority on this subject is Ross, who lived from 1829 to 1833 among the Eskimos of Boothia Felix. In his 'Narrative of a second voyage in search of a north-west passage' (London, 1835, pp. 356 and 373), he refers to two brothers who had one wife, and mentions this as a thing of frequent occurrence. Probably, however, it is not real polyandry, but a state of things brought about by the prevailing custom among them of lending the wife to an intimate friend. Murdoch says that the winter houses in the great middle region, from Hudson Bay northward, are generally of snow, built upon the frozen ground. Throughout this district dug-out winter houses are in frequent use. They have a subterranean entrance, the rear part of the roof being at a level with the ground, and the front being formed by a large whale-rib covered with seal intestines, which admits the light. The roof is made

of beams, over which are spread two covers of seal-skin, the intermediate space being filled with shrubs. In referring to Sutherland's measurements of the Eskimos of Cumberland Sound, Murdoch remarks that they may have been half-breeds. Sutherland visited the Sound only a few years after its discovery; and there were no grown-up half-breeds there at that time, though they form a large portion of the population nowadays. The tribes of that district are in the habit of cooking the food for their regular meals; but besides this, they eat large quantities of raw and frozen meat. They indulge in drinking oil as little as any other tribe. Murdoch remarks rightly that it is far too valuable to waste in this way, as it is the only and indispensable fuel.

NOTES AND NEWS.

THE board of oriental studies at Oxford has added Chinese and Burmese to the list of languages which may be offered in the examination.

— Prof. Edward A. Freeman has been obliged by ill health, the result of overwork, to obtain leave of absence from Oxford for a time. He is now in Sicily.

— The report of the Swiss commission for the reform of gymnasial instruction has just been issued. The commission recommend that the teaching of Latin shall begin in the fifth class, and shall be continued, for five hours weekly, up to the highest class; that instruction in Greek shall depend upon the expressed desire of parents or guardians, and shall begin in the fourth class; and that all scholars who do not learn Greek shall learn either English or Italian. Two spare hours gained by pupils in English or Italian are to be spent in the study of natural science and mathematics.

— The *Educational times* remarks that the event of the month — January — has been the visit of the French teachers to Oxford — the members of the Société nationale des professeurs de Français en Angleterre — for the holding of their sixth annual congress. They lunched at different colleges, and assembled thereafter in Balliol hall, where they were received in a most eloquent speech by Dr. Jowett. That master spoke highly of the value of modern languages and the promotion of their study in England; but he loves his Greek better. "Modern languages in Oxford," he said, "must serve the higher purposes of education: therefore they must not drive out the ancient, and, above all, Greek, which, more than any other ancient language, seems to be the original source of our literature and civilization."

Other speeches were made, and the following excellent resolutions were carried: "1. That the Society of French masters earnestly desires to see established at Oxford a school of modern languages, on such a basis as will encourage the study of French literature, and of the French language as a living tongue; 2. That the society desires that the system of set books in the local examinations of Oxford and Cambridge be abolished, and that certificates be awarded on translation at sight, composition, grammar, and *viva voce*." Later, the members dined together at Oriel, where they were entertained by the provost and a committee of reception. Toasts and more speeches followed dinner; Dr. Beljame, the representative of the French minister of public instruction, expressing an eloquent hope that the old friendly intercourse between French and English universities would be renewed. Altogether, the Oxford meeting was a very pleasant success, enjoyable, and of much benefit to all concerned.

— The English educational papers are bewailing the appointment of Sir William Hart Dyke to succeed Sir Henry Holland as vice-president of the council of education.

— Hawaii is not unprovided with educational facilities. The education act compels the attendance at school of all children between the ages of six and fifteen. The government supports free public schools out of a tax of two dollars per head, paid by every male inhabitant of the kingdom between the ages of twenty and sixty years. An inspector-general is at the head of the school department, but no person in holy orders or minister of religion is eligible to fill the office.

— An association for promoting the university education of teachers, consisting, in the first place, of the masters of English elementary schools who spent some weeks at Oxford last summer, has been inaugurated in London. As its first act, the association has appealed to the education department to recognize the university degree as equivalent to a certificate, "provided the universities co-operate by making provision for training in teaching."

— Of late the Prussian minister of education has had several applications made to him to admit women as students at the universities. His reply is, that women are not to be admitted as regular students at any Prussian university, nor at any of the medical schools.

— Cornelius Nepos is a particularly good author for beginners in Latin to take up, because his style is easy and perspicuous, and his subject-matter, when trustworthy, is of historical interest. The

little volume of selections from Nepos that has recently appeared in Macmillan's series of elementary classics is at once the handiest and best-prepared edition for the use of beginners that we remember to have seen. It is edited by G. S. Farnell, M.A., who has prefixed a brief introduction, and appended some helpful notes and a vocabulary. The passages for Latin composition are a good feature, and should materially aid the teacher.

—The programme for the annual meeting of the superintendents of schools, concluded yesterday at Washington, was a comprehensive and attractive one. The subjects of discussion, and the speakers invited to discuss them, were as follows: 'Public education on the Pacific coast,' Superintendents Campbell of Oakland (Cal.), Waterman of Stockton (Cal.), and Fay of Eureka (Nev.); 'A teacher's certificate, county, city, state, and national,' Dr. A. J. Rickoff of Yonkers, J. P. Wickersham of Lancaster (Penn.), Dr. W. A. Mowry of Boston, Superintendent Lovett of Huntsville (Ala.), W. W. Jones of Lincoln (Neb.), and Superintendent Hard of Gallipolis (O.); 'Civil service and public schools,' L. D. Brown of Columbus (O.), Superintendent Manley of Galion (O.), B. L. Butcher of Beverly (W.Va.), Superintendents Morgan of West Virginia, Barringer of Newark (N.J.), Littlefield of Newport (R.I.), and Ballard of Columbus (O.); 'Powers and duties of officers and teachers,' Superintendents Marble of Worcester (Mass.), Cornell of Denver, Hinsdale of Cleveland, Wise of Baltimore, Latham of Danville (Ill.), Green of Long Branch (N.J.), and W. E. Sheldon of Boston; 'The best system of county and city school supervision,' Superintendents Holcombe of Indiana, Greenwood of Kansas City, Johnson of Columbia (S.C.), Sabin of Clinton (Io.), Paine of Tennessee, Spear of Kansas, and Macdonald of Topeka; 'The best system of state school supervision,' Superintendents Easton of Louisiana, Edwards of Illinois, Preston of Mississippi, Pickett of Kentucky, Lawhead of Kansas, Palmer of Alabama, Buchanan of Virginia, and Tomlinson of Winston (N.C.); 'The relation of our public schools to the general government,' Congressman McKinley of Ohio, A. J. Michael of Cleveland, and Superintendents Newell of Maryland and Cooper of Texas.

—Writing from Paris, the *Journal of education's* correspondent mentions two subjects of general educational interest. The first is, that there is at present a perfect glut of teachers in the scholastic market in France. The impetus given by the republican government to education has caused such an influx of young men and young

women to the profession, that more than twenty thousand who have gone through the necessary training and passed the examinations cannot find places. Most of these would, under ordinary circumstances, not have become civil-servants; and the increase in the number of these, in a country where the true function of the state is considered by too many to be that of providing posts for its citizens, is a very serious matter. The second topic of interest is that the Chévé method of singing at sight is gaining ground in France, as well as in Belgium and Holland. Although not so thorough in fundamental principles as the tonic sol-fa method, which has done such a vast deal for singing in England, this method stands next in order of merit. The degrees of the scale are indicated by figures, instead of by letters as in tonic sol-fa. He adds that it is a curious fact that Germany, where rational and irrational methods on every possible subject are being daily elaborated with exemplary care and Teutonic patience, still plods on with the old method, which has but one point in its favor compared with the above-named; namely, that it is the only possible method, practically speaking, for instrumental music. But as a means of affording a ready insight into the principles of modern music, it can hardly be called a method at all.

—The *Athenaeum* reports that a movement in favor of university extension, somewhat after the lines of Professor Stuart's scheme, which Cambridge has worked with signal success, is being proposed in Scotland. The University of Glasgow is considering the subject, and St. Andrews has formed a committee which is to inquire into the need for instruction and its capability of supplying it. Several of the Edinburgh professors have signed a rather vague fly-sheet that has been put in circulation; but no general conclusion has been reached, and it is uncertain whether the universities will divide the work among them, each acting separately, or whether there will be a common organization. In fact, the question in Scotland takes a different form from what it does in England. England had a large body of comparatively idle fellows: Scotland has none. When Professor Stuart began his work, there were large districts in England untouched by university influence: there is almost no such district in Scotland. The number of undergraduates at Oxford and Cambridge is small in proportion to the population: the number of Scottish students is very large. These and other circumstances will compel the Scottish universities to handle the question in a way somewhat different from that pursued by Professor Stuart.

LETTERS TO THE EDITOR.

**Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.*

Zoology in the college course.

THE recent appearance of three zoological text-books, so diverse in treatment as to be well-nigh contradictory, revives the question, 'How shall zoölogy be taught?' The three books to which I refer are Packard's 'Zoölogy,' Colton's 'Practical zoölogy,' and Sedgwick and Wilson's 'General biology.' The first of these has already proven its popularity by passing through several editions. But popularity and real merit are not identical in meaning. Professor Packard's work is a conspectus of the animal kingdom: it may justly be termed an elementary study of the classification of animals. The student is constantly brought to view orders or classes as exemplified in a few types selected for study.

Sedgwick and Wilson designed their work for college use. The latter part of it is an introduction to the study of zoölogy. It is the counterpart of Packard's 'Zoölogy.' In it the principles and facts of classification are not first in importance, but the student is kept upon the study of one animal until he has mastered it from every stand-point, — anatomical, histological, embryological, and also to some extent physiological.

Colton's 'Practical zoölogy' occupies a place between the other two. It was not designed for use as a college text-book, and we should not speak of it here but for the fact that it will be used in many colleges, and we consider that it has serious limitations if used for this purpose, and should be largely added to, to make it capable of doing proper service. The work is virtually a set of superficial studies of the gross anatomy of a variety of animals arranged without reference to classification. Only the most easily seen features in the anatomy are touched upon, and all the more difficult ones are omitted.

We consider these text-books as representing two distinct ideas in zoölogical teaching, and the third a compromise between them: first, the view that the student of zoölogy should have at least a glimpse at every large group in the animal kingdom; second, the view that the student should have a very full fund of information about a very few forms; and the third, the attempt at bridging the chasm between them. The first view leads to superficial knowledge of the whole, the second to thorough knowledge of a part, and the compromise secures neither result.

Before considering the relative merits of these two ideas, we must be careful to make it understood that we are speaking now of a college course in zoölogy, and neither, on the one hand, a high-school course in natural history, nor, on the other hand, a professional course in zoölogy. Zoölogy is not taught in college to make zoölogists: it should guide such study of the phenomena of animal life as will best increase the powers of observation or quicken the activity of perception, but, at the same time, not omit to acquaint the student with the principles of the science, and ground him well for future deeper study, should he ever wish to pursue it. If the college course has, then, this twofold purpose, — to develop the student's powers and to show him somewhat of the science of zoölogy, — two questions arise: what is zoölogy as a science, and does it train the mind aright by its pursuit?

Zoölogy was advanced from a dry collation of ill-understood facts to a living science, and with this growth its study has outgrown its old place in the curriculum. The progressive colleges give it more prominence and a strong force of instructors, and furnish laboratories, etc., for work. Even the most conservative have seasoned the ancient and dishonorable practice of a course of lectures on zoölogy without any laboratory work, with some work upon the animals studied. With this change should go the desire, dear to so many instructors' hearts, to inform the student with all the facts he has gathered after long toil. As we discard the false notion that even the briefest course must still include some knowledge of every group, and realize that by 'elementary' we mean, not more dilute knowledge of a great variety of creatures, but thorough knowledge of fewer, we are in a position to use the laboratory for its legitimate purpose. This purpose is to study animals as the zoölogist studies them, not fully enough to learn all zoölogy, but fully enough to intelligently understand the work of the zoölogist, including the student of physiology and pathology, securing at the same time zoölogical training just so far as the study is pursued. It is all wrong and pernicious for the teacher to feel that he must get his class 'over the ground.' There is no limit to the amount to be done, and he can't 'go over the ground' except most superficially. The feeling that each large group must receive some attention, however slight, is really most harmful, though very wide-spread. The experiment is tried every year of making students apprehend principles before they have mastered enough facts, and it is always most unsatisfactory in its results.

Zoölogy is not at the present time chiefly concerned in the discrimination of species, which forms but a minor issue; but the bulk of study is in the direction of anatomy and histology, embryology and physiology. These studies all lead later to the consideration of many very difficult problems, and among them those of classification; but the zoölogist is not in a position to attack these at the outset of his study. At first he must pursue many little details, tiresome or fascinating as the case may be, such as fine dissection, section-cutting, with minutest attention to the processes of hardening, staining, embedding, cutting, and mounting, careful study and interpretation of sections, various careful experimental observations, and all these attended to with all possible precision. No one has a right to claim a notion of the science of zoölogy who has not had considerable training in such work, met some of its difficulties, and thus acquired information for himself along the arduous road of the zoölogist. Furnished thus with facts, he is ready to take some of the higher steps of the scientific zoölogist and seek the law which unifies his observations or the general principle which underlies them. How valuable an idea of the cell, its derivation, differentiation, etc., has one who has gotten his idea of cells from black-board drawings? But let him study the growth from embryonic epidermis of skin, hair, nail, and gland, and differentiation begins to take on meaning.

While only direct observation can give the student an adequate conception of the science of zoölogy, it at the same time secures to him the very best for which natural science training is of educational value. It is not so much the variety of observations as their exactness which produces valuable results in this direction. Nothing so irksome as exactness, nothing

so unusual, but nothing so desirable in education, whose purpose is, not to make things easy, but to strengthen ability to master difficult ones. It is just this training which zoölogy should furnish.

It may be set down as certain that in the brief time usually allotted to zoölogy in college no student can master both the technique of zoölogy and a complete survey of the classification. It is also certain that he cannot acquire without laboratory work a zoölogist's conception of, we will say, a crustacean. He may dissect a cray-fish and then be informed that it is a crustacean, in which case he merely understands the terms 'cray-fish' and 'crustacean' to be synonymous. But let him take a cray-fish or lobster for his first study; let him dissect it and study its cellular structure; let him study its larval stages. From it let him go to other macrourans and compare their forms, all the way from *Gebia* to *Hippa*. Let him have access to the systematic treatise, and hunt out the genus and species. Let him compare it with the schizopod and the crab, and with the megalops of the crab, and he will then form some adequate conception of the zoölogist's meaning of a crustacean.

We believe this to be the true way to teach zoölogy, for we doubt the value to a man of a mass of indefinite ill-digested text-book information. Occasionally an omnivore can take in every thing, and digest and so metabolize it as to organize it into healthy mental tissue. They are, however, the few.

If the requirement of zoölogy from a text-book be such as this outline would indicate, obviously no text-book can ever fully meet it. For the systematic work no smattering key but the original description should be consulted if possible. Upon the anatomy and histology the student should have the use of original articles, monographs, etc. This is, however, not always possible, but the nearest approach to it should be the chosen course. Sedgwick and Wilson's work comes the nearest to being such a text-book of any with which we are familiar. We should have preferred the selection of some animal with a larger circle of cousins and other relatives, both near and distant, and think that a crustacean or a coelenterate might be taken to exhibit better the science.

It will mark a long stride of improvement for the science of zoölogy when teachers and examiners will be content to allow the student to become broad only after he has been narrow, in place of exacting of him a large amount of varied information which is only skin deep, will foster and encourage methods of work which will make him the master of the facts. The real test of the merit of a zoölogical student should be made to lie in what he can do, how much he can see,—his ability to demonstrate facts in zoölogical science, and not merely or chiefly, as at present too largely, in how much he knows.

L. H.

Elementary instruction in zoology.

Seldom have I read an article, among the many that have been recently published dealing with that all-important question as to why biology should constitute one of the leading educational branches in the schools and universities, with more interest than I did the one contributed by Prof. H. W. Conn, and published in the issue of *Science* which appeared upon the 18th of last month.

To my mind, it not only presents in the most masterly manner why biology should be introduced into the curriculum of every grade of school, from

the primary classes to the university, but how, within the near future, such a happy result will with great certainty come about.

I can remember very well how, a number of years ago, I read with the keenest interest all of Huxley's now classical essays upon this subject, and watched the untiring efforts of his to force upon the attention of those in authority in educational matters in England the prime importance of an early introduction of the biological studies not only into the graded schools, but into the curriculum of every university.

There are many, many teachers and educators in this country to-day that now hold the views of Huxley in nearly all essential particulars; and those who have thoughtfully followed, step by step, the growth of the natural sciences with us, since the early days of this century to the present hour, know full well that the time is not far distant when the education of the individual will by no means be considered a liberal one, unless it comprehends a very clear understanding of the principles of biology in their widest sense.

For more than a quarter of a century it has been my good fortune to have been able, in common with others of my date in the fields of science, to watch and study the several highly interesting phases through which the natural sciences have successively passed. These phases seem to divide themselves naturally into three quite well-marked stages; and these stages may be characterized by comparing them with the way in which any animal or group of animals has been studied. In times gone by, naturalists dealt first with the mere description of animals,—the narrative stage, as it were,—and the literature of the subject partook almost exclusively of this style of treatment. But as the knowledge of animals became more accurate, and freed of its mythical taint, why, then the needs of the minds of men demanded more than this, and the subject naturally passed into its second stage, and the study became highly classificatory. Classification reduced the enormous amount of almost chaotic descriptive literature to order and system. Next the study of the natural sciences gradually passed into its third and present stage, wherein classification is being checked and corrected by the wide-spread attention that is being devoted to the subject of structure,—the morphology of animals. It is needless for me to add here that the outcome of the present phase is slowly bringing to light a knowledge of the fundamental life-principles of organized nature, and an understanding of the universal laws that apply to the whole.

As the pressure of the necessity for the teaching of biology in the schools became greater and greater in recent times, it was soon followed by the outcropping of the text-books to be used for the purpose; and it has been with the very deepest interest possible that I have studied the casting of these very volumes. Some of them have still clinging to their pages many of the traces of the 'narrative' phase of the science; others are largely classificatory; while still others, intended even for the youngest minds, deal chiefly with morphology,—with healthy hints of a juvenile calibre, at the underlying principles of life, judiciously introduced.

From this point, space now demands that I be brief in my remarks; and I will, in concluding, simply present my matured views upon the subject of elementary teaching in biology, irrespective of any of

my reasons for holding them, or any defence of my convictions in the premises.

As to the age at which children should first take up the study of biology, I contend that it largely depends upon the aptness of the individual child, and the capacity for teaching of the instructor. My oldest son is not yet quite ten, and he can pass a stiff examination upon Morse's 'First book in zoölogy,' name the bones of the vertebrate skeleton, comprehends the general principles of a natural classification, reads well, and has his other studies fully up to those in biology, and, finally, makes an unusually creditable drawing *direct* from any natural object. I would say, then, to those children to whom all the advantages of the schools are open, that they may safely begin with their first steps in zoölogy and biology at nine years of age.

As to the methods, I would say, then, for a child of nine years of age, that mere descriptive zoölogy be simply considered a part of his general reading; that such training as comes from the study of the naming of animals I would surely confine to a very limited list of the commonest forms of the several groups, but let these be thoroughly understood; and I would say right here, that, even at this age, it is truly wonderful how well a child can comprehend the general principles of nomenclature, if they be properly presented to him. Even clear through the university course, I am by no means an advocate of the student putting forth the effort to commit to memory the names of animate objects, even so far as they apply to the fauna of his own country. Coming next to classification, I would say that this, too, be borne upon but lightly at first, though *its principles* can be introduced at a very early stage in the programme of biological education. What I object to, is the early course of zoölogical studies being based upon any system of classification. I agree with Professor Conn when he says that "classifications have, by reason of recent discoveries, grown so intricate and complicated that they no longer can be taught to the general student with any degree of satisfaction." But the principles of classification, as I say, can be easily made clear to the child; and it soon learns to grasp these, and prattles quite learnedly as to why bats are grouped with the mammals, and whales are not fishes!

By this time I expect my views upon this part of the subject have been anticipated; and I hasten to say that my firm convictions are, that the principle upon which biology should be taught to children, is to begin with the study of *TYPES*. Not only that, but I contend that it is the question of a study of types that should be held to, all the way through the entire course of study, until the day of graduation at the university.

And, figuratively speaking, at all ages these studies must be pursued with text-book in one hand and the actual specimen in the other, with the lens and scalpel constantly at work.

If we start in with a child nine years of age, and commence to carefully point out to it, constantly using fresh specimens, all that can be learned from the body of any *one kind* of small animal, appropriately illustrating it as we proceed with a sufficient number of the proper kind for comparisons, and introducing at the same time the simpler laws of chemistry and physiology, it is absolutely marvellous the interest that can be aroused, and the progress that is the outcome of it all. Children soon learn, too, to

make wonderfully good sketches of their work, and may be easily taught to compare them, and lay them aside for future use.

The text-book for this purpose, treating, as it ought to, of a few types, should be thoroughly and carefully illustrated; and none of the systems should be in any way neglected or hastily passed over. Take the muscular system, for example. For children nine years of age, it will only be necessary to illustrate the larger and more important muscles of the trunk and extremities, but good figures of them must be given in the text-book; and, say the instructor has before him as his type some such an animal as a squirrel, he can easily lay bare the biceps in the fore-limb, and, in an attractive way for children, speak of the composition of a muscle, show the physics involved in its leverage, and say how it is found in most all vertebrates with fore-limbs, how in mammals it is inserted into the radius, and in many birds into the ulna; its presence in ourselves can at once be demonstrated upon any child present; and so on. Lessons of this kind, I know from personal experience, are entered into with a growing interest, and are pursued with an ever-increasing profit.

So far as I know, to my mind, the text-book in zoölogy and biology, for the use of our children from nine to fifteen years of age, remains yet to be written.

R. W. SHUFFELDT.

Fort Wingate, N. Mex., March 5.

Thought-transference.

I read with much surprise Mr. Edmund Gurney's letter on the article of which I gave an account in *Science* of Feb. 4. I thought I had made it quite clear that I was simply saying, in part in my words but mostly in their own, what two ladies had written on an overlooked factor in thought-transference. As these ladies have so clearly proved their ability to speak for themselves, I will take the liberty of forwarding them a copy of Mr. Gurney's letter, and, if they think it advisable, they may answer it.

The reason why I consider the article important is because it tells us something new and interesting about the 'number-habit,' not on account of its bearings on thought-transference. The latter point of view, however, was that which interested the authors of the article, and I thought it better to adopt their form of statement. The bearing of this fact on psychic research is to me of rather trivial interest compared to the psychological value of the fact itself. I fear there is great danger of magnifying the importance of psychic research in general, and of forgetting that it forms only a small and that rather an unimportant part of psychology.

It seems to me perfectly fair for the writers of the article in question to omit any detailed reference to the work of the English society; and I, for one, did not draw from it the inference which Mr. Gurney draws, — that they suppose the argument to apply to *all* the work of the English society. I do believe, however, that the principle has a very much wider application than Mr. Gurney supposes. The writers of the article in question took for granted some acquaintance with the work of the English society; and the charge of misrepresentation seems to me unfair against them, as I hope it is also unfair against my account of their article.

It can hardly be of interest to any one but myself to know that Mr. Gurney's own attempt at 'thought-

transference' has been a failure. Not only have I read every page accessible to me of the writings of Mr. Gurney and his associates, and have begun reading the 'Phantasms of the living,' but, on the whole, I have spent more time in this department of literature than I care publicly to confess. The only justification with which I console myself for all this reading is the glimpse here and there of an interesting illustration of the psychology of 'psychic research' itself. If I have overestimated the importance of the article I reported, it may have been due to the bright contrast it afforded to so much of the literature on that topic with which I have come in contact.

J. J.

Baltimore, Md., March 12.

To some of the facts brought out by the English branch for psychical research, and which seem to me well established,—quite as well, indeed, as many facts in physical science which scientists accept because they cannot explain,—the American branch of the same society enters its demurrer. "The tests of so-called investigators have been rendered quite unreliable by the fact that they were themselves the dupes of their own ideas." Now, the investigator *may* be the dupe of his own fancies,—that is most true,—but his fancy may be a susceptibility favorable to the fact, or a non-receptive susceptibility, that would require more than a logical train of possibilities to dispel. He may be such a slave of sceptic habit, that the normal freedom of his judgment is weakened by preconceived ideas so tyrannical as to make of him a bigot. In scientific investigation the one man is as worthless as the other,—on the one hand, the scientific man who *will not* be convinced; and, on the other, the one who will be too easily convinced.

Humanity is made up of compounds pretty well known; and it seems hardly probable, that given the same opportunities, and with mental calibre of equal power, the English men of science should be the victims of their own fancies to a larger degree than those in the United States. So I take it that dupe No. 1 prevails in Europe, and dupe No. 2 in America. It will always be found difficult to explain psychological phenomena upon physical bases,—more than difficult: it is impossible. The theories followed out by the American branch do not seem to me to be applicable. In the first place, it is not a fact in mental science, that because the power of thought-transference occurs in one person, it must occur to a certain extent in all persons, or in at least a great many persons; and I very much question the existence of any mental system constructed upon the relation of the digits or the determination of numbers. Starting out with these preconceived, firmly rooted, and untenable hypotheses, the investigator has already made himself the dupe of an idea. He is the victim of the society's explanation. He comes to the work totally unqualified as an unprejudiced observer, because he is already prejudiced by preconceived trains of thought, originated by the society to which he belongs, and exaggerated by his own in-dwelling upon the subject. He has withdrawn from mental freedom something absolutely necessary to its unfettered action, and cannot give to the investigation that just and honest study which alone can be of service. The number of men in the world's life capable of passing such judgment is exceedingly small: they could be counted upon one's fingers.

A man may be revered in the realm of letters, of astronomy, of medicine, of natural history, etc., and yet it is more than probable that he cannot bring to a crucial test of psychic phenomena the freedom of judgment that is necessary. In the very nature of things, I should doubt most strongly if a physicist is ever the proper person to pronounce upon metaphysical processes, because his whole habit of thought has been in a different direction.

To accept nothing as positive that has not been proved dwindles our world down to the geometrical conception of a 'point,' which has position without dimension: it makes of human life a mere idea, that as yet lacks logical method, and is without definite fashioning; and robs every one that takes the life-giving oxygen into his lungs without knowing why he does it or what ultimate purpose it subserves, of the very sweetest hope that a student can have,—that some day the mysteries that now torment us shall be made as clear as the noonday sun. This is not the test of psychological phenomena, and never can be.

I can understand, from a very considerable experience in hospital work on the continent, that many conditions of self-deception are self-created. A man may be the victim of excessive introspection, and may conjure up mental states of being and mental imageries which to him are absolute. Another may receive into a ductile mind as truth certain disputed ideas, because he has already tilled the ground for the reception of the seed. Another will fail to receive any thing, because he has determined either that he will not, or that, if he does, it will conflict with his preformed scientific conception of the matter. Both of these latter are certainly dupes. I have seen a few examples of thought-transference; but even the few were so unmistakably the evidences of a new force or power, and so free from any suspicion of fraud, that I cannot deny the possibility because I am unable to explain the fact. I certainly do not incline to relegate such power to the mere rudimentary conditions of elementary human life; neither has it been my experience to find that the agent or percipient were persons in whom the intellects were at all weakened. We know so little of consciousness, of brain-power, and of the power of the senses, that we should blushing announce ourselves as ignorant and blind, before opening the door that leads to regions of which the wisest know absolutely nothing.

I am writing merely as my thoughts suggest, and not at all as one versed in this the most abstruse of all sciences; and these thoughts have been called out by a study of the plans and purposes of the society for investigating these phenomena. It seems to me that the ends and purposes aimed at are handicapped at the outset by certain definitions and premental conceptions that must be more or less dominant, and thus tyrannize over the understanding; so that the very man who thinks himself free becomes the dupe of preconceived ideas. The instinct of the animal that leads him to interpret certain moods of his master, and which is of a part with the whole transmission of heredity,—the automatic action, so to speak, of the higher nervous ganglia, or the impress that these ganglia have acquired by similar experiences through hundreds of preceding generations,—is quite another thing from the complex phenomena of thought-transference, which are the exponents of a much higher degree of civilization, calling for a much more elaborate and intricate association of psychic functions.

If even the least significant of all of the facts reported from England be accepted, we are left to deal with an unknown something quite apart from instinct, — something, for so it seems to me, which cannot be compared with it in any way, but which is the evidence of a higher order of brain-manifestation than we have yet met with.

HORATIO R. BIGELOW, M.D.

Leipzig, Feb. 28.

The tail of *Chlamydoselachus*.

A recent opportunity of examining a second specimen of *Chlamydoselachus* furnished the means of adding an item or two to our knowledge of that peculiar genus. In several points the example differed from that originally described. This was notably the case with the tail. On the later capture, this organ was a little more than one-fourth of the total length, and, with the vertebral column, tapered to a sharp extremity; whereas in the first one it stopped abruptly, with vertebrae of considerable size, as if truncate. On the new one, the lateral line, with a few short breaks posteriorly, continued to within an inch of the end of the tail. All this indicates that the tail of that which served as the type was deformed and incomplete: the deformity, in all likelihood, being of embryonic origin. Proportioned as the new one, the tail of the type would have been seventeen inches long, instead of which it was but little more than ten. Completed, the type would have had a total length of sixty-six inches, to a circumference of eleven and a half. The more recent specimen had a length of forty-eight, to a circumference of ten and a half inches, which made it rather less slender and snake-like than its predecessor.

Another difference occurred in the dentition, which, in the last examined, showed variations in the number of denticles between each lateral cusp and the median: sometimes there were two, sometimes but one.

The trochic folds, abdominal keel, were present, as on the specimen from which the original description was taken.

S. GARMAN.

Cambridge, Mass., March 11.

The Quebec group.

Thinking it may be interesting to geologists to learn the latest conclusions in reference to the stratigraphical succession and distribution of the rocks in the province of Quebec, hitherto known as the 'Quebec group,' I send you the following brief observations on this subject: —

As is well known, the divisions made by my predecessor, the late Sir W. E. Logan, of this interesting and exceedingly complicated group of formations, were in ascending order, — Levis, Lauzon, and Silsery, — and these together were supposed to represent a peculiar phase of the calciferous and chazy formations of the New York lower paleozoic series. I have elsewhere made known as the result of personal investigation that portions of several systems and formations had evidently been included in the Quebec group as described in the 'Geology of Canada, 1863,' and depicted on the geological map of Canada, published in 1866. During a personal examination of a large portion of the area during the seasons of 1876, 1877, and 1878, I recognized strata which I

considered clearly belonged to systems and formations ranging from pre-Cambrian to Silurian; and also that much of the so-called 'Sillsery' was in reality not the youngest, but the oldest member of the group, and of pre-Cambrian age.

All subsequent investigation has confirmed the correctness of these conclusions, first advanced in a paper read before the Natural history society of Montreal in February, 1879, and more fully treated in reports and papers since published in 1880, 1883, and 1884. Since the date of the last of these publications, considerable additional information relating to the distribution of the several formations has been acquired; and I now find that no less than four distinct horizons can be recognized, each of which is marked by important bands of conglomerate. Three of these (Nos. 2, 3, and 4) are fossiliferous limestone conglomerates, while one (No. 1) is chiefly felspathic and dioritic, is non-fossiliferous, and generally presents the appearance of a volcanic agglomerate or breccia, which in places becomes a brecciated serpentine, or is otherwise variously altered, and is often schistose and micaceous, — pre-Cambrian.

No. 2 is of Cambrian age, and is best seen along the south shore and at the north end of the Island of Orleans, at Bic, at Metis, and at several points lower down, on the south side of the St. Lawrence Gulf.

No. 3 is the celebrated Levis conglomerate, well exposed at Point Levis and at the south-west end of the Island of Orleans. It is interbedded with gray and dark blue highly graptolitic slates, recognized by Professor Lapworth as marking the phyllograptus zone of Europe. It also recurs with its associated phyllograptus slates at several points between Metis and the Marsouin River on the south shore of the St. Lawrence, always in discordant contact with the strata of the preceding group.

No. 4 is the limestone conglomerate of the Quebec Citadel Hill. It occurs there in three or four more or less lenticular beds, none of which exceed six feet in thickness: they are associated and interbedded with black highly carbonaceous and graptolitic strata, yielding a valuable cement-stone. Both to the north-east, before reaching the Island of Orleans, and to the south-west, these beds are cut off by the curving line of the great St. Lawrence and Champlain or Appalachian fault, and are brought into abrupt contact with the red and greenish gray slates of No. 2. They appear again, however, on the south side of the St. Lawrence near St. Antoine, and thence pass beneath the drift-covered level country to the south-west. I believe these beds to be a part of the Utica, Hudson River, or Lorraine group. Professor Lapworth, who has recently examined the graptolitic fauna from these rocks, considers it to denote a stage older than Trenton limestone, but decidedly newer than the Levis phyllograptus zone. The latter view is entirely in accord with the stratigraphical evidence as first published by me in 1879; but, so far as the stratigraphy is at present known, it is as decidedly opposed to the former conclusion. Lists by Professor Lapworth, of the graptolites from the different horizons above named, will appear in the volume of the Transactions of the Royal society of Canada, shortly to be published.

The fauna of No. 2 conglomerate, as well as that of the associated slaty and shaly beds, is exclusively of Cambrian type, — *Dictyonema sociale*, *Eophyton Linneanum*, *Cruziana* (?) *Paradoxides-Archaeocyathus*, etc.

The fauna of No. 3 conglomerate is mixed Cambrian and lower Cambro-Silurian, while that of the associated slaty beds is exclusively lower Cambro-Silurian.

The fauna of No. 4, though also mixed, is chiefly of Trenton Lorraine age, as is that of the associated slates.

The mineralogical and lithological characters of the four groups are as markedly different as are their paleontological features, and the former present a striking correspondence with those which characterize the pre-paleozoic and lower paleozoic formations of the Lake Superior region.

Altogether the structure in the vicinity of Quebec seems to correspond very closely with that described by Mr. S. W. Ford in his 'Observations upon the great fault in Rensselaer county' (*Amer. Journ. sc.*, vol. xxix, January, 1885).

In the Quebec area the great fault not only exists, but has many subordinate and more or less parallel branches. The most important of these crosses the main Quebec anticlinal at Danville, in Shipton township, and runs thence south by the Missisquoi valley to Mansonville, in the township of Potton, on the Vermont boundary. In many places these dislocations have, as described by Mr. Ford (*op. cit.*), placed the older rocks on the top of the newer. Such an occurrence is well seen in the gorge of the Nicolet River near Danville, where the black Cambro-Silurian limestones and shales dip directly under gray wrinkled quartzose pre-Cambrian mica-schists, and one would suppose the two series to be in conformable sequence; but not far removed, in the township of Tingwick, a small outlier of the same black limestone rests flat on the upturned edges of the mica-schists, as do other similar outliers elsewhere in the district.

It is quite evident that Appalachian geology can never be satisfactorily interpreted and explained without careful and minute study in the field of the numerous great shoved, more or less parallel, faults by which the whole region has been affected, and due consideration given to the marvellous effects they have produced on the structure.

ALFRED R. C. SELWYN.

Ottawa, Can., March 9.

Notes upon the erosive power of glaciers as seen in Norway.

The above heading is the title of a paper in course of preparation, of which the following is a *résumé* in part:—

(a) As many of the Norwegian glaciers are rapidly advancing, they arch over from rock to rock, and leave sub-glacial caverns into which the explorer can go long distances.

(b) Numerous angular and sub-angular stones, as well as those rounded by atmospheric erosion, are resting upon the crystalline rocky beds with the ice flowing about them; that is to say, the resistance due to the friction between the stones and the rock is greater than the cohesion of the molecules of the ice, which flow about the obstacles as a viscous body. Even stones resting upon loose and soft morainic matter, over which the glacier is advancing, are sufficient to channel the ice as it moves over, in place of pushing it along.

(c) No blocks were seen in the act of being torn

up from the subjacent rock, nor were the loose stones being picked up.

(d) A large rounded boulder, held in the ice, was being rolled, in place of shoved, along by glaciers, as shown by the mouldings in the ice. At the same time, it was being crushed.

(e) The abrasion by the falling of detached masses of ice and stones is considerable.

(f) A tongue of ice, hanging from the roof of a cavern, was pressing against a loose boulder, that a man could have moved. In place of pushing the stone, or moving around it, the tongue of ice, of about a cubic yard, was being held suspended by a sheet of ice bent backward, nearly at right angles, in a graceful curve.

(g) Scratched stones were rarely seen among those falling out of the bottoms of glaciers, and in many places the rocks were scarcely, if at all, scratched. Although occasionally highly polished, the subjacent rocks, even where scratched, showed generally surfaces roughened by weathering, or with only the angles removed.

(h) The upper layers of ice were seen to bend and flow over the lower, wherever low barriers were met with, in place of the lower strata being pushed up by an oblique thrust.

(i) A glacier was advancing into a morainic lake, and, in part, against the terminal barrier. In place of ploughing up the obstruction, the strata of ice were forced up into an anticlinal, along whose axis there was a fracture and fault. Thus domes of ice covered with sand were produced. The sand had been deposited upon the surface of glaciers by the waters of the lake. The conformability of the sand and the strata of uplifted ice was undisturbed, except along the line of fault. As the domes melt, cones of sand with cores of ice are left. By the lifting process the morainic barrier is covered with clayey sand, as if subjacent strata had been ploughed up by the glacier, of which there was no evidence.

(j) At several places where glaciers are advancing over moraines, they are levelling them, and not ploughing them out. This levelling process is by the dripping of the water from the whole under surface. In fact, even the loose stones upon the water-soaked moraines were sufficient resistance to cause the bottom of the ice to be grooved.

(k) The fall of a great ice-avalanche from a high snow-field, down a precipice of a thousand feet, to the top of a *glacier rémanié* was seen. These falling masses of ice bring down the frost-loosened stones from the sides of the mountains upon the glacier, which is charged with *détritus*. It is this material which furnishes mud to the sub-glacial streams, and not the rocky bed of the valley worn down by glacial erosion.

(l) One does not find that the glaciers *per se* are producing hummocks. These are the result of atmospheric and aqueous erosion, although perhaps beneath a glacier, which sweeps over them, and to some extent scratches and polishes them. The effects of glaciation in removing angles and in polishing surfaces are small compared with atmospheric erosion upon the same rocks.

(m) The transporting power of glaciers is limited to the *débris*, which falls upon its surface from overhanging or adjacent cliffs, and afterwards works through the mass or comes to be deposited at its end.

J. W. SPENCER.

University of Missouri, Feb. 28.

SCIENCE.—SUPPLEMENT.

FRIDAY, MARCH 18, 1887.

SLÖJD¹

I HAVE been asked to give some account of the slöjd system, as practised in Sweden, having lately visited that country in order to study the system both practically and theoretically. This visit convinced me of its excellence, of its claim to be regarded as an important factor in education, and the need there is for something of the kind in our own schools.

The word 'slöjd' is essentially Scandinavian, and an equivalent for it is not to be found in any other European language. Its original meaning is 'cunning,' 'clever,' 'handy' (compare '*sleight* of hand'), but, as at present used, it means rather the different kinds of hand-work used in schools for educational purposes. 'Slöjd' is such a convenient word, and embraces so much, that I think we shall have to naturalize it in England, and call it 'sloyd.' It has already been adopted in France and Germany, and I believe in Belgium, Austria, and Russia.

There are many kinds of slöjd, or hand-work, practised in the schools in Sweden, Norway, Denmark, Finland, Germany, and other countries, — simple metal-work, smith-work, basket-making, painting (trade), fret-work, book-binding, *papier-maché*, needle-work, and finally wood-slöjd, which consists mainly of carpentry, but in which carving and turning may play a subordinate part.

Herr Otto Salomon, the director of the seminary at Nääs, has drawn up a table in which the above occupations are compared, under the following heads :—

1°. The children's interest gained ; 2°. Work which can be used ; 3°. Order and precision ; 4°. Cleanliness and neatness ; 5°. Development of sense of form ; 6°. Accordance with children's capacity ; 7°. Strengthening and developing of the physical powers ; 8°. Counterpoise to sitting ; 9°. Capability of methodical exposition ; 10°. General dexterity.

It appears, from a careful comparison of the results obtained by means of these various occupations, that while several of them answer to the above tests in certain particulars, yet only the *wood-slöjd* can answer all.

I will endeavor to give a brief outline of the chief principles of the method for the teaching

of manual work which is followed at Nääs, and which has thence been largely disseminated all over Scandinavia and Finland, and is taught even within the arctic circle. In Sweden alone, wood-slöjd is practised in eight hundred national schools, has been introduced into the secondary schools for boys, and is now being adapted even in the upper schools for girls.

It has also been introduced into France, Belgium, Germany, Austria, Russia, and the United States. It will probably be taken up in Abyssinia, through the instrumentality of the Swedish missionaries ; and even far-distant Japan is showing an interest in the subject. Are we English to be left hopelessly behind in the adoption of hand-work as an important factor in education ? We have already accepted it — in a very limited way, it is true — in the adoption of the kindergarten system, the very soul of which is its response to the child's need of activity and production ; and slöjd is the same principle at work, only in a form suited to the growing powers of our boys and girls.

Herr Salomon himself has treated of the results aimed at by slöjd, the choice and classification of models, and the question who is to be the slöjd teacher, in a work which has already been translated into French and German, and will soon, I hope, appear in English.

Slöjd aims at the following results :—

1°. To implant respect and love for work in general ; 2°. To implant respect and love even for the coarser forms of honest manual work ; 3°. To develop activity ; 4°. To foster order, accuracy, cleanliness, and neatness ; 5°. To encourage attention, industry, and perseverance ; 6°. To develop the physical powers ; 7°. To train the eye and the sense of form.

The joining of the slöjd course should be voluntary on the part of the pupil : consequently the work should fulfil the following conditions :—

1°. It should be useful ; 2°. The preparatory exercises should not be too fatiguing ; 3°. They should offer variety ; 4°. They should be executed without help ; 5°. They should be real work, not play ; 6°. They should not be knick-knacks, or so-called fancy-work ; 7°. They should belong to the worker ; 8°. They should be in harmony with his power and physical strength ; 9°. They should be of such a nature that they can be finished with exactness ; 10°. They should allow of cleanliness and neatness ; 11°. They should demand thought-

¹ From the *Journal of education*, Feb. 1, 1887.

fulness, and thus be more than a purely mechanical work ; 12°. They should strengthen and develop the physique ; 13°. They should help to exercise the sense of form ; 14°. Lastly, as many tools and manipulations as possible should be employed.

Such are the results aimed at ; but here a very important question arises, Who is to be the slöjd teacher ? Teachers are already so overburdened with work, that it seems too much to expect them to undertake another subject. But for them, too, a subject so novel, and necessarily so differently taught from the ordinary school-subjects, would doubtless have its attractions, and would illustrate the saying, 'Change of work's as good as play.'

Whether this be so or not, the slöjd instruction must be undertaken, not by an artisan, who would naturally regard it merely from its mechanical side, whereas the main object of slöjd is not the teaching of any trade, but the development of the faculties, and the acquiring of general dexterity. It must therefore be given by a trained teacher, who understands the nature of the material on which he has to work, viz., child-nature, and, if possible, by the same teacher who takes the other school-subjects.

I may mention that by means of slöjd, which necessitates individual supervision and instruction, the teacher has an opportunity of obtaining an insight into the character, and of establishing a personal relation between himself and his pupils, which it is almost impossible to obtain by means of class-instruction. Numbers of teachers can bear witness to the truth of this statement. The teacher should lead, direct, and control the work, but should be careful not to put his hand directly to it. In order to be able to follow with advantage the course of instruction, the pupil ought to have reached a point of development usually attained about the age of eleven.

One word as to the main differences between wood-slöjd and ordinary carpentering, with which it is very apt to be confused. These lie, 1°, in the character of the objects made, which are usually smaller than those made in the trade ; 2°, in the tools used (the knife, for instance, the most important of all in slöjd, is little used in ordinary carpentry) ; 3°, in the manner of working (the division of labor employed in the trade is not allowed in slöjd, where each article is begun, carried on, and finished by the same pupil) ; 4°, but the fundamental difference is in the object of slöjd, which is, not to turn out full-blown, or half-blown, or even quarter-blown young carpenters, but to develop the faculties, and specially to give general dexterity, which will be useful, whatever line of life the pupil may afterwards follow.

As individual instruction is generally required, and as this manual work cannot be taught in class, the same teacher can only superintend a limited number of pupils at the same time. Generally speaking, there should not be more than twelve.

As to the choice of models : 1°. All articles of luxury are to be excluded ; 2°. The objects made are to be of use at home ; 3°. The children should be able to finish them entirely without help ; 4°. The articles should be made of wood only ; 5°. No polish should be used ; 6°. As little material as possible should be employed ; 7°. The children should learn to work both in the harder and softer woods ; 8°. Turning and carving should only be sparingly employed ; 9°. The models should develop the children's sense of form and beauty, and for these ends the series should include a certain number of modelled objects (for instance, spoons, ladles, and other curved articles), which are to be executed with a free hand, and chiefly by eye ; 10°. By means of going through the whole series, the pupils should learn the use of all the more important tools. In the choice of models, care should be taken that each one prepare for the next.

As to classification of models : 1°. The series ought to progress without a break from the easy to the difficult, from the simple to the complex ; 2°. There must be a sufficient variety ; 3°. Each model must be so placed in the series that the pupil shall be able to carry it out entirely without the direct help of the teacher, by means of what he has already made ; 4°. The models should constitute such a series that at each step the pupil may be able to make, not a passable, but a correct work ; 5°. In making the first models, only a few tools are to be employed, but as the series is carried out new tools and new manipulations are to be employed ; 6°. The knife, as the fundamental tool, is to be the most used in the beginning of the course ; 7°. For the first models, rather hard wood should be employed.

At the beginning of the series the models should be capable of speedy execution, and objects which require a considerable time should be gradually reached.

Let us now see whether slöjd, if the foregoing conditions be carried out, may be regarded as a factor in education, whether considered physically, mentally, or morally.

It is essentially a form of work which calls forth every variety of movement, which brings all the muscles into play, and which exercises both sides of the body. It is so arranged that the children can work with the left hand as well as with the right, in sawing, planing, etc. Thus all the

muscles are strengthened, a more harmonious development attained, and there is less fear of their growing crooked. There is no reason to dread their becoming left-handed: in more delicate manipulations, the right hand will always remain the better man of the two.

Does slöjd help forward the mental development? Surely work which draws out and exercises energy, perseverance, order, accuracy, and the habit of attention, cannot be said to fail in influencing the mental faculties; and that it should do so by cultivating the practical side of the intelligence, leading the pupils to rely on themselves, to exercise foresight, to be constantly putting two and two together, is specially needed in these days of excessive examinations, when so many of us are suffering from the adoption of ready-made opinions, and the swallowing whole, in greater or smaller boluses, the results of other men's labors.

We want whole men and women, the sum total of whose faculties is developed, who have learned to apply their knowledge, not only in the emergencies, but in the daily occurrences of life; and this readiness — this steadiness of nerve, the ordered control of that wonderful machine the body, the cultivation of the practical side of us — can only come by exercise, and this is given by means of slöjd. Let us also remember that all skilled work, however humble it may appear, is brain-work too: the hand is the servant of the brain. If any one doubt this, let him try to make, from first to last, some complete object, however insignificant, — be it the modelling of a leaf, cube, or even a ball, or the making of a wooden spoon, — and, I answer for it, he will gain a new respect for hand-work, not only from its usefulness, but the skill it requires.

What does slöjd do for the moral training of the child? It implants respect and love for work in general, including the coarser kinds of bodily work. In the fierce competition which exists in all civilized countries (and nowhere fiercer than in our own), which springs in so many cases from the desire to push on to some fancied higher level of life, what a clearing of the moral atmosphere would be effected if the rising generation could be imbued with the feeling, deepening as they grow up into conviction, that it is the *man* who dignifies or degrades the work, — that all labor which proceeds from a worthy motive is of equal worth, and that the right work for each one of us, and consequently the noblest, is the work we can do best!

But this is not all which slöjd effects in the way of moral influence. It tightens and strengthens the bond between school and home. Every thing

which the child makes is for home use, is prized there as his own honest work, and as the product of the skill which he is gaining at school. Among the working-classes, the actual use of the things made by the children (besides the wholesome pleasure and pride they call forth) is found to do much, in the countries where slöjd is practised, to reconcile the parents to their children remaining at school even when they are beginning to be of use at home and to be able to earn something. They have tangible proof, in the objects brought home, that their children are learning something which makes them useful and handy, and which will make them readier in future in learning a trade.

I will only mention one other point in which slöjd bears good moral fruit. I mean, it implants in the child a sense of satisfaction in honest work, begun, carried on, and completed by fair means and by his own exertions. In these days of scamped work, of dishonest tricks to be found in all trades and manufactures, what can we say too much in praise of a system which will give our boys and girls a sense of the dignity of work, a scorn and contempt for what is slovenly or tricky? The slöjd system is completely opposed to the modern principle of division of labor, which is no doubt a necessity in the present conditions of life, but which would be disastrous in education, where the aim must be the development of each individual, not the getting through a given quantity of work in the shortest and cheapest way. I feel sure that a boy or girl who, at a period when impressions are most lasting, has had the solid satisfaction of carrying out a piece of work from beginning to end, will not be satisfied, in adult life, with becoming a mere machine for drilling holes, putting on pins' heads, or turning out chair-legs by the hundred, but will, in his leisure hours, vindicate his dignity and skill by doing some work, whether practical or intellectual, worthy of a human being. We must remember, too, that a large part of the distress in bad times is due to the fact, that, if the particular fragment of work which a person is capable of is taken from him, he can do nothing else whereby to earn his bread.

I can only speak in the briefest way of the crying need there is for some such practical training as is given by slöjd. I am not an enthusiast for the particular form of it which I have studied myself at Nääs, and which I have seen at work in the Swedish schools, where I wish I could transport you, so that you might see for yourselves the earnestness and energy of the young workers, the dexterity with which they handle their tools, their extreme carefulness (for no damaged or careless work is passed), and the independent manner in

which they work. But I do say, that we want something of the kind, suited to our national needs and character, and bearing the same fruit of trained intelligence and skill which it is producing in the countries where it is practised. A great deal is being done in England for technical education, and a great deal is said as to its need, for there is a very real danger of English workmen being driven out of the field on account of the superior skill of foreigners and the great advantages they enjoy in the way of technical education. We can but rejoice that we are beginning to recognize this danger, and that so much attention is being directed to the need of technical education; but even supposing the country were covered with technical schools, if our young people come to them with eyes and hands untrained, with little or no sense of form and beauty, with lack of perception and habits of observation, with untrained and undeveloped muscles, how can they possibly hold their own against the youth of other countries, coming fresh from schools where eye and hand have been trained to general dexterity, which will stand them in good stead whatever special branch of technical work they may take up, with trained observation and perception, and with a love for work and an interest in it which has been quickened and stimulated by many a victory gained by perseverance, attention, and energy?

Should this slöjd instruction be given to girls as well as boys? This question has already been answered practically in the affirmative in Sweden, and with excellent results. It is just as important for a woman to have the complete use of her hands as for a man. It may be said that girls have needlework, which is more suited to their sex, and more useful to them in after-life. It would be a very sorry thing for our future wives and mothers not to learn the use of their needle, but why should they not learn needlework and slöjd too? The use of the tools would develop their muscles, and they would gain an added dexterity which needlework alone cannot give. And besides this general development, which is of paramount importance, the positive knowledge gained, and the power of doing little jobs about the house, would be of great service to them when they grow up.

But, it will be objected, even granted that a universal hand-education should be given, including both sexes, and granted that teachers are forthcoming who are capable of giving it, how is it possible to spare time for another subject? I will only reply, that the schools in Sweden are among the best in Europe, and yet they find time for it. The slöjd classes — which are entirely voluntary

— are held in the evenings, so as not to interfere with the ordinary school-work.

For the girls of our higher schools it seems to me even more important than for their sisters of the working-classes. The latter have to help their mothers at home in many active ways, and get, at all events, plenty of movement and variety of occupation; but the former, who have not so many active games as their brothers, and who are often unable to be much out of doors in bad or severe weather, are lamentably in want of some interesting active work as a counterpoise to the continual sitting and poring over books and exercises. Slöjd of some sort is the very thing they need. I am persuaded, that, if only we set our shoulder to the wheel in this matter, we shall find in this hand-education the true remedy for overpressure of brain, which is not an invention of the doctors.

You will perhaps wonder where all the teachers of slöjd, so universally taught in the Scandinavian schools, are trained. A slöjd seminary has been founded by Herr Abrahamson, a wealthy Gothenburg merchant, on his beautiful estate of Nääs, within easy reach of Floda station, on the main line between Stockholm and Gothenburg, and about an hour by rail from the latter.

This seminary was founded in memory of Herr Abrahamson's wife, in 1872, and he has spared neither time, money, nor effort in making it a worthy memorial. There is also a model school for boys and girls in connection with it, so that those who are in training may see the system actually at work among the children. I may mention, in passing, that this school has a great reputation, and that children are sent from considerable distances to attend it. The seminary is directed by Herr Otto Salomon (Herr Abrahamson's nephew), who is quite an enthusiast in the cause of slöjd, and devotes his life to the spread of the system in other countries as well as his own, and to the improvement of it in practical details. The seminary, which is built very picturesquely of timber, in the old Norwegian style, is situated in Herr Abrahamson's park, close to the lovely lake of Sävelängen. It consists of large work-rooms fitted with double rows of carpenters' benches and racks all round for the different tools, a large lecture-room, a sitting-room for the gentlemen, a small one for the ladies, and a room where the models and finished works are kept. Upstairs is sleeping accommodation for thirty men. In addition to the seminary, there is a pretty little house close by, called 'Vänhem' (friends' home), where the lady students live, who form a very small minority of those who attend the course. There are also other cottages in the neighborhood, where

the overflowing numbers attending the course are accommodated.

There are four slöjd courses given in the course of the year,—two summer and two winter courses. Each course lasts six weeks; and, as the time is so short, the hours are somewhat long, and the work rather hard, for those who are not accustomed to much bodily exercise. The plan of the day is as follows: prayer, 6.45 A.M.; lecture, 7 to 8; breakfast; slöjd from 8.30 to 1, with a break of a quarter of an hour; dinner and rest, 1 to 3; slöjd, 3 to 5; coffee, followed by discussions, either on the slöjd models—which are apt to be very lively—or on ordinary school-subjects, for Herr Salomon is anxious to take advantage of the presence of so many teachers by giving them frequent opportunities of hearing each other's views, and thus rubbing each other up by means of a little wholesome friction.

The whole number of models, consisting of a hundred articles, is divided into two series,—fifty in the first course, and fifty in the second. Many of the teachers return in order to go through the second course, and are sure of a hearty welcome. At the end of the course, each member receives a certificate, in the presence of the whole body, stating that he or she has attended the course, and has made so many models. No special number is required. Every one is anxious to get on; but strength and ability vary considerably, and those who come with a knowledge of carpentering soon leave those who have had no such previous practice hopelessly behind. But all gain much during the course, quite enough to begin a slöjd class on their return to their respective schools, in different parts of the world.

The difficulty of teaching together representatives of so many different nations is not so great as it seems. As far as the practical work is concerned, the chief thing is to be shown how to work, handle the tools, etc., and the primitive language of signs goes a long way. The lectures are more difficult to manage, and I can only say how they were given at the course I attended. A daily lecture was given in Swedish and in German. The former was attended, not only by the Swedes, but by the Danes, Norwegians, and Finlanders, who understand Swedish well. The latter was attended by the Austrians, Bohemians, and English. If we had known no German at all, I believe we should have received some private instruction.

A few words, in conclusion, as to the life at Nääs. I think the thing which, above all, struck us, was its complete novelty. We felt as if we had dropped into another planet. The mixture of nationalities and languages, the simplicity of the mode of life, the early hours, the general kindli-

ness, the absence of all class-distinctions, the child-like enjoyment of little pleasures, the good-tempered rivalry in work, made up a sort of hyperborean Arcadia. On the other hand, it is only fair to say that the general arrangements are so primitive, that no one should go there who cannot put up with a certain amount of roughing it and very simple fare. I may mention here, in case any one should feel inclined to spend the summer holidays in going through a course of slöjd at Nääs, that ten pounds would well cover the whole cost of the undertaking. A first-class return ticket from London to Gothenburg is £5 5s. (this does not include food). The journey to and from Nääs is short and inexpensive, and a very small sum, about 1s. a day, is charged for food. Application should be made some months beforehand to Herr Otto Salomon, Nääs, Floda station, Sweden.

Another pleasure was the excellent singing, generally given in the open air, specially during the long solemn evenings of the north, when the air was alive with song. A choir was formed of the best male voices, under an excellent conductor, a member of the course, who took great pains with them. The quarter of an hour's rest in the morning was often turned to good account in the musical line. We used to sit about outside the seminary, while the choir would stand on a knoll and give us song after song till the bell rang, summoning us to return to our labors. Will you think it strange that this going to school again was also a pleasure? We quite enjoyed to be the pupil instead of the teacher, and were amused to find how much our point of view had changed since we were *in statu pupillari*. But, let me whisper, we should probably not have enjoyed it had it been for more than a very limited time.

We are proud, and justly proud, of our position as Englishmen; but I think we can well afford to recognize more heartily and generously the quota which each civilized nation brings to the intellectual wealth of all. Even those who are small in population, and not so well endowed as ourselves with natural advantages, do their part relatively perhaps better than we; and Swedish education, during this century, has advanced by leaps and bounds. I will only remind you of these three facts: it was a Swede, Captain Nordenskiöld, who, in the little Vega, first made the north-east passage; it was a Swede, Herr Henrik Ling, who has given to the world the most scientific and comprehensive system of gymnastics; and it is Sweden who again comes forward and offers us the hand-education, which, if rightly used, is to give our children a completeness in their training which is at present lacking.

EVELYN CHAPMAN.

ASPECTS OF EDUCATION.

HUMANISM.—II.

HUMANISM, in the hands of Sturm and his followers, was at least intelligible and masculine. Although it was founded upon a narrow basis, its aims were clear and honest. In the next two hundred years, humanistic teaching was to undergo an influence of a very different character, which, maintaining the outward show, changed the substance and turned what was a modified blessing into a decided curse. The Jesuit schools founded in the sixteenth century obtained so much vogue in the seventeenth and eighteenth, that they influenced the whole of European education, Protestant as well as Catholic. They had one title to respect, and one only. They were the first to bring the individual teacher face to face with the individual pupil. Whatever their objects may have been, and whatever were the ends for which they intended to use their influence, there can be no doubt that they did from the first what they still do,—attempt to study the workings of each individual mind and the beat of each single heart. Here their merit ends. They desired that the hearts of their pupils should be devoted to them, and not to humanity, and that their minds should never move out of the limits which they themselves should fix. Humanism lay ready to their hand. Here was a subject on which infinite ingenuity might be expended and endless time wasted. To become a complete master of the style of Cicero, Horace, or Ovid, might take a lifetime; yet the result was showy: few could understand its merit or the processes by which it was reached. To declaim on speech-day a long *alcaic* ode on the immaculate Virgin, or to turn the Song of Solomon into the language of Ovid's 'Art of love,' was an achievement which all might admire. The Jesuits were the inventors of that bane of humanistic education, the exaggerated reverence paid to Latin verse composition. What can be a worse training for the human mind? A mind is called well trained in language when it can conceive accurately the idea which it wishes to express, and can express that idea in language which no one can misunderstand. The whole theory of original Latin verse composition is opposed to this. The pupil is set to write a copy of verses on a set subject, be it spring or winter, autumn or summer. His notion of what he should say is very hazy, but under pressure he will write down twenty so-called ideas for twenty lines of Latin verse. To expand these he will have recourse to his *gradus*, a book which the Jesuits have the credit of inventing. He will there find so-called synonymes of the Latin words he has chosen, which cannot really express the same

sense, for in any language very few pairs of words are to be found with precisely the same meaning. If his synonymes are insufficient for the purpose, he will fill up the line with epithets chosen from the *gradus*, not because they are just, or appropriate, or needful, but because they scan. If these are not enough, his handbook will furnish him with phrases of greater length, bearing more or less upon the subject, and even with entire verses which he may introduce, so far as he can do so without fear of detection. To spend much time on this process is to play and juggle with the human mind, to make pretence at thought when there is no thought at all, to mark time instead of marching, to work a treadmill that grinds no corn, to weave a web which must be perpetually unravelled; yet in the latter half of the eighteenth century we see original Latin verses the chosen task of school-boys and a too frequent pastime for statesmen.

Let us not condemn all composition in dead languages. To turn the masterpieces of modern poetry into an exact Greek or Latin equivalent may be the worthy occupation of the best-trained scholars. It has more than once happened that the copy has been more poetical, more musical, more worthy, than the original itself. Nor is imitation of any literature which we are studying to be despised. The Italian sonnets of Arthur Hallam, the French lyrics of Swinburne, if not genuine poetry, are at least precious fruits of the poetical mind. But if these fruits are to be produced at all, it is necessary that they should be produced without compulsion. Train your scholar in the best examples of Greek and Latin, let him study Virgil, Homer, and the Greek tragedians night and day, show him all the poetry they contain, let him compare them with the best productions of his native tongue, and the probability is, that, if he has any creative faculty, he will begin to imitate and will write Greek and Latin verses without coercion. But set him down on a form with fifty other boys, and bid him write poetry on a subject for which he does not care, in a language which he does not understand and which is often unfitted to the thoughts which he has to express, guide him by mechanical rules, and assist him with mechanical handbooks: you will then find that what ought to have been a pleasure has been a barren toil, and that his mind is dulled by the effort. Even at the present day, after all that has been written against Latin verses by those who are most fit to judge, they hold an inordinate place in English classical education, and give us good reason to pass the strongest condemnation on the sect which introduced them.

The falseness of Jesuit principles of education

goes further than this. They can best be judged on the great annual festival when the parents are invited to see the triumphs of their children. Speeches in different languages are delivered by children of various ages, often with a pathos that draws tears from those who hear them: this is a good part of their training. The head boy reads out the list of those who have gained prizes. After reciting a string of names, he suddenly pauses, thus attracting the attention of all present. The prefect of studies, who stands behind him, comes to his rescue, and utters the boy's own name, which he has been too modest to pronounce himself. Had he repeated it among the others, it would have attracted no attention, but the modesty which avoided the appearance of self-laudation was used to extort the applause of the multitude.

The boys are examined *viva voce*. Nothing can be more fair. Any one at random is asked to take a Virgil or Sophocles, to submit any passage for translation, and to ask any questions he pleases. If the examiner does his work honestly, he soon finds what a mistake he has made. He submits a passage for translation. The boy makes a mistake; the examiner stops him. The boy blunders; the examiner insists upon a correct translation, which takes a long time in coming. There is general discomfort and confusion. The whole sympathy of the audience is with the good-looking ingenuous youth on the platform, and not with the bald-headed pedant who is examining him. The examiner asks a question; the boy answers it wrong. As often as the examiner rejects the answer given to him, so often does the impatience of the audience arise against the stupid man who does not know how to ask questions that the boys can answer.

If the Jesuits had no faults of their own, they at least deserve the condemnation of posterity for suppressing their rivals the Jansenists, who offered to France the best opportunity of receiving a humanistic education devoted to the noblest ends. The object of the distinguished men who founded the little schools of Port Royal was exactly the opposite to that of their Jesuit rivals. They desired to make the moral character of their pupils strong and independent, and to train their intellects from the first in the severe studies of close and logical reasoning. In the individual attention they gave to their pupils, they were superior even to the Jesuits. The whole number of children that passed through their schools was small; and no teacher was allowed to have charge of more than five or six, while the masters were thus able to study the characters and capacities of their pupils in the minutest details. Pains were always

taken to avoid undue familiarity. Between the pupils themselves, as between their professors, there was to reign a dignified and temperate courtesy, removed equally from sickly sentimentality and from rough and boisterous good-fellowship. The grammar of Port Royal was not a collection of rules to be learned by heart, but a treatise on logic, which forms the basis of all grammar. Where rules or examples had, of necessity, to be learned, they were, in disregard of precedent, placed in such a form as to be most easily remembered. The Jansenists were guilty of another innovation which gave a great handle to their opponents. They taught the dead languages of antiquity from the living tongue of their own France. What impiety, said the Jesuits, thus to vulgarize studies which ought never to be presented to us without solemn and even sacred associations! We hear little or nothing in the Port Royal schools of the cultivation of Latin verses. The air which they breathed was too bracing for that trivial exercise. On the other hand, they did great service to the study of Greek. It is true that the Jesuits maintained Greek as a prominent study in their schools, which the University of Paris had been compelled to surrender by the clamor of parents. Yet the 'Garden of Greek roots,' an attempt to popularize the study by imparting the most necessary knowledge of Greek in French verses, remained for a long time a standard school-book, and was used for that purpose by so careful and exact a scholar as the historian Gibbon. If the Jansenist schools had been suffered to exist, they might have profoundly affected not only the course of study in France, but the minds and characters of Frenchmen. European nations, in following the French models of excellence which reigned without dispute before the French revolution, might have had a more masculine type held up for their admiration. This, however, was not to be; and French literature, impregnated with Ciceronianism, had been but slightly touched with the chastening influences of Hellenic studies or of logical precision.

Humanism has undergone many changes in the last generation, and it is difficult to forecast its future. The position which it held in education after the revival of learning was due to two opinions about it, which were believed very generally, but not always very consistently. On the one hand, it was thought to be the best gymnastic for the mind, the best mechanical exercise which the human faculties could be put through. On the other hand, the literatures of Greece and Rome, which were the subject-matter of humanism, were regarded as absolutely the things best worth study, not only from their intrinsic merit,

but from their forming the best introduction to all modern studies. Not many years ago modern geography was taught in the most distinguished of English schools by what was called a comparative atlas and a comparative geography-book. Ancient geography was taught first as the thing most needful, and modern names were only dealt with as the correlatives of ancient ones. A good English style was supposed to be acquired from the study of classics. Latin verses formed the best introduction to English poetry; Latin themes were the best method of learning all general information. Even now at our universities many people would maintain that the science of modern statesmanship could not be better learned than from Aristotle's 'Politics.' Both these points of view have suffered rude shocks. Undoubtedly from considerations which were indicated above, Greek and Latin, and Greek especially, do form an admirable training for the mind. Latin grammar is more precise, more logical, and in these respects harder, than the grammars of modern languages. The Greeks were probably the most gifted people who ever lived, and their language was adapted in a wonderful manner to express most perfectly their most subtle thoughts. To a mature scholar, who recognizes every shade of his meaning, Thucydides will appear untranslatable. The words as he puts them down, whether grammatical or not, express precisely what he intends to say, with a vividness and a directness which cannot be surpassed. To express all that he would tell us in English would require long clumsy paraphrases, and even these would not express it altogether. The effort made by a modern mind to follow in its subtlest folds every sinuosity of the thought of Plato or Aristotle is in itself a very valuable training; but to profit by this training, a considerable standard in the languages must have been reached, and as years go on, the number who reach this standard is fewer and fewer. The foundations have been undermined, boys and parents avoid the trouble of learning dead languages, and teachers are ready to escape the trouble of teaching them. The result is, that only the chosen minority are in the position of profiting by a training which was once universal; and these have such distinguished and apprehensive intellects that they would almost always make a training for themselves.

If humanism has suffered by the growth of a disbelief in its powers as a gymnastic, there is no sign that its intrinsic worth is rated less highly than it was. Indeed, as we begin to appreciate more exactly the necessary elements of culture, our respect for humanism grows greater. We are told that there are two great elements in modern civilization, — Hebraism and Hellenism. There is

no fear at present that the first will not be well looked after. No Christian country is without an efficient church establishment; and the training of the clergy in all their several degrees, who are the chosen guardians of Hebraism, is more extensive and more satisfactory than in previous generations. Take away Hebraism, and the most valuable part of our intellectual furniture which remains is Hellenism. That can only be preserved by the combined efforts of all those who are indebted to it, and who have learned its value. This is the special function of schools and universities. It is remarkable that each attack made on the study of Greek has produced some new effort to make the study of Hellenism more general. The establishment of the English Hellenic society was the direct result of an attempt to exclude Greek from the entrance examinations of the university. The growth of science has been coincident with the revival of acted Greek plays, both in England and America. The dead languages which were once revered as a training are now valued for what they can teach us; and scholarship is defined, not as the art of interchanging in the most ingenious manner the idioms of the Greek, Latin, and English languages, but as the calling-back to life of the Hellenic world in all its branches. Hellenism need not always mean the study of Greek life and thought. Egyptian culture preceded Hellenic culture. The Greeks went to study in the schools of Egypt, as the Romans frequented the universities of Greece, and as the English visit those of Germany. As the learning of the Egyptians, whatever it may have been, has been absorbed for our purposes partly by Hellenism and partly by Hebraism, so Hellenism itself may be absorbed, so far as it deserves to be, by modern literature. One who knew Milton by heart would be no poor Hebraist, and he who possessed the whole of Goethe would be no mean Hellenist. But this time has not yet arrived, if humanism suffers now from a slight obscurity, due to its unfortunate attempt to claim too much mastery over the human mind; yet there is no fear of its being materially obscured, and the assistance which it may yet render the human race, in her search after the good, the beautiful, and the true, should command the sympathy, and stimulate the efforts, of every man to whom those objects are dear.

OSCAR BROWNING.

SCHOOLS IN EGYPT.

THE report of the minister of public instruction for 1875 shows a total of 4,817 schools in Egypt, with 6,045 teachers and 140,977 students. Of these, 4,685 schools and 3 so-called universities

having, in all, 5,307 teachers and 127,138 students, were purely Arabic; 93 schools, with 416 teachers and 8,961 pupils, were sustained by the various foreign colonies and religious communities; the remainder being under governmental control. Statistics since 1875 are in great part not obtainable; but it may be safely said, that, during the past twelve years, almost no change has taken place in the Arabic schools, while the other two classes have made great progress.

The native education is, for practical purposes, valueless, as it consists in mere memorizing, the other faculties being entirely neglected, of which the outcome is a mechanical acquaintance with a list of facts; and even that is lost when the formulaic order is destroyed. At almost every street-corner in the cities, behind a fountain, is a native school, presided over by a sheikh, who instructs from ten to one hundred boys in committing the Koran to memory. In 1875 these schools were attended by 112,000 children. The instruction consists in repeating over and over again a single verse, until the pupil has learned it. The droning of the children is always accompanied with a swinging motion of the body, which is supposed to facilitate the mental effort.

The university course is much the same as that of the elementary schools, the Koran being the centre and end of all instruction. At Cairo is the University El Azhar, the most celebrated stronghold of Mohammedan doctrine. Its students number seven or eight thousand, and come from all Mohammedan countries. The studies are the memorizing of the Koran and of the commentaries, grammar, language, and law (but only so far as they are interwoven with the faith), and a smattering of Aristotelian philosophy. No time is devoted to mathematics; history and geography are despised, and every foreign language is rigorously excluded as dangerous to the religion of the faithful. Students sometimes spend a number of years at the school, and at the end of the time are fitted for nothing more than to become caliphs or teachers of Arabic in foreign schools, at a salary of one or two pounds a month.

The schools managed by foreigners, especially those of the American and English missions, are European in organization, and are accomplishing some excellent results. In them much time is devoted to the study of English and French, a knowledge of which is of increasing value and importance in Egypt. These schools are attended by pupils of all nationalities and religions, and many of them are open to both sexes.

Government supervision of schools has existed for forty years; but until lately the system was overrun with abuses, and barren of results. Dur-

ing the last two years a new *régime* has been entered upon, and the government schools now offer excellent advantages. They are of three classes,—primary, preparatory, and higher special schools. The primary schools, for children from eight to twelve years of age, throughout the four-years' course give instruction in the Koran, Arabic language and penmanship, arithmetic, and object-lessons of the kindergarten character. To these studies are added, after the first year, drawing and the geography of the Ottoman empire; after the second year, French, English, geometry, and Egyptian history. Under the head of *civilité et éducation*, the pupils are taught the principles of politeness, cleanliness, moral habits, and so forth. The object-lessons give elementary instruction in physics, mechanics, and in various industries. The preparatory schools continue the same courses, adding, in the first year, physics, chemistry, natural history, algebra, and moral philosophy. The results obtained from these schools is encouraging, though the incompetence of Arab teachers to adopt modern methods is a great drawback. A ministerial decree of 1886 founded a normal school at Cairo "to train professors for the schools of Egypt, and to popularize good methods of instruction." In the normal school the course of three years is a continuance of those of the two lower grades of schools, with the addition of instruction in hygiene, psychology, pedagogy, and gymnastics. Small scholarships are offered to the most deserving students.

Among the other special courses are schools of medicine and law, two good schools of technology, and a school of languages. Much good work is being done, especially in the departments of modern languages, a knowledge of which is necessary to obtain a government position. Much remains to be done, but the energetic efforts of the government have fixed a standard of thoroughness in education which must soon result in a higher degree of intelligence and less of mechanical knowledge among the people. R. ARROWSMITH.

DOES EDUCATION DIMINISH INDUSTRY?

THE London *Spectator*, at once the most serious and dignified of papers, recently published an article of which the above is the title, which took for the subject of its comments the plan now being advocated in England for introducing workshops into the national schools. As the same plan is coming into prominence in this country, the *Spectator's* remarks will interest our readers. The writer in question says that many critics of the present system of primary instruction in England fear that it will breed up a generation with a

distaste, and even contempt, for manual labor. "The boys make less trusty workmen, and the girls worse cooks and housemaids and laundry-women." They "are less handy and more conceited than a former generation; have less liking for work, and more 'notions.'" As this language is used in advocating a specific project, it is perhaps too strong to be critical; but there is no doubt it expresses a feeling very general not only with 'the classes,' but with employers of labor of all degrees, and especially with employers in a small way. Moreover, behind all these complaints, some of which are justified, for the English have as yet been too busy making up leeway in the battle with utter ignorance to attend sufficiently to technical education, there rests an idea general enough and broad enough to deserve attention, — the idea that education is in itself inimical to continuous industry. A lad who expends some years in acquiring knowledge will not, it is fancied, betake himself willingly to the drudgery of manual labor, will avoid it, even if he loses by the avoidance, will crowd into the towns, and will go perilously near starvation in any easy employment, rather than work with his hands for fifty-four hours a week. The old method of training lads through apprenticeship to the necessary habit of endurance is breaking up, and with it the mechanical aptitude transmitted through generations which made the acquisition of the necessary knowledge almost unconscious. The working lad's mind has expanded, however little; and he will not, it is contended, work as he did. It is quite right that the subject should be stirred, for, if the theory of the objectors is true, the look-out for the world is but a poor one. Some of the most necessary tasks are disagreeable tasks. Somebody must cart the muck, dig the drains, unload the ships, stack the coals, carry the bricks, or the world will stop; and a resort to slave-labor would be criminal, or to excessive pay highly inconvenient or impossible. Machinery will not do every thing; will not, for instance, before making the bricks, excavate and damp the clay for filling the moulds. The human hand is still, in many departments of labor, the only conceivable as well as the only available machine. Education cannot be stopped; and if, therefore, education develops an aversion to hard work, humanity will stand in presence of a nearly insoluble problem. The chance even is serious, and attracts the more attention because there is some *prima-facie* evidence that the danger is real. One clever race, the Jew, which, though often uneducated, has just the kind of intellect that education by itself produces, steadily and successfully avoids hard manual labor. The Hebrews all over the earth will not

plough, yet they contrive to live. Another, the Yankee, which is educated, dislikes work so much that it is said that its true destiny is to oversee workers, and that a Yankee sitting on the gate to drive other men to labor is worth five Yankees in a field. The drift towards the towns, which in all countries follows education, and is now covering Europe with huge centres of population, is believed to be in part caused by the hope of obtaining 'light' tasks; and the excessive increase of competitors for clerkships has been for years matter of constant observation. The clerks swarm in ever-increasing numbers, till their wages are driven down to starvation-point, and they declare themselves incapable of living under a competition which seems to have no bounds. There are trades, we believe, now, in which the clerks pay the employers. Some of the peoples of the continent are penetrated with the notion that instruction is fatal to willing labor. Mr. Hamerton, in his wise book on France, declares that the peasants think a son who has gone to school outside the village is lost to their work, and believes that in the main they are right, the lads who have been instructed revolting against the unbroken toil, the penury, the calculating thrift, essential to the peasant life. English dealers of the lower class say a lad must be taken young, or he will never succeed; and in one trade at least, that of a sailor, the rules in favor of beginning early are made immutable, the old hands knowing from experience that the life is intolerable to most of those who have tried any other.

On the other hand, no dislike of work, and especially no dislike of agricultural work, which is at once the roughest, the most continuous, and the worst paid, has appeared among two of the best-educated races. The Scotch, who have been taught for two hundred years, and are now far more thoroughly trained than the English national-school boys, show no disposition to avoid labor, but are, on the contrary, remarkable for persistent and fairly contented industry. There are thousands of Hugh Millers among them, though without his genius. The Prussian peasants, who are as educated as the English will be twenty years hence, work exceedingly hard, and in the country, where their holdings are their own, show none of the resentment at their fate which is no doubt manifested in the towns in the form of socialist aspirations. Gardeners, who all over Great Britain are the best instructed of manual laborers, work, more especially when working for themselves, with unusual diligence; and it is matter of constant observation that a laborer who happens by any accident to be a 'bit of a scholar' can be depended upon when work presses and every

man is required. The people of Rome, who can read and write, are far more diligent than the Neapolitans, who cannot; and the best workmen in Italy are those who have passed through the army, and so obtained what is practically an education. There seems no *a priori* reason why it should be otherwise. Attendance in the schools, which are well ventilated and warm, notoriously improves health, and there is no evidence whatever that it diminishes strength in the lower class any more than in the upper, who decidedly benefit by school-life. Nothing recognizable, in fact, happens to the child who is taught, except a break in his habit of steady endurance, which is met in the agricultural schools by the system of half-time, and does not appear to impair industry in factories or workshops. Cultivated lads — we mean lads 'well educated' in the conventional sense — work in scores in the founderies, learning the engineer's business through a most severe physical apprenticeship; and lads who emigrate without capital constantly work at hard tasks as well and as steadily as ploughmen; often, moreover, acknowledging a complete contentment with their toil. They feel monotony when there is monotony; but they do not resent hand-work any more than thousands of educated Canadian or New England farmers. On the whole, and subject to the evidence which can only be supplied by many more years of observation, we should say the truth was something of this kind. Education of the modern kind does not diminish industry, and does not, except for a very short period, break the habit of assiduity at work. Nor does it diminish the readiness to do manual labor in those who can do it, though it does diminish their number, — the 'delicate' lads, as their mothers call them, who, if left uneducated, would have gone on in the groove of their forefathers, taking by a species of natural selection to the lighter tasks. The remainder work as before, though probably not in the old, machine-like way. They spare themselves more, are more quick to avoid unnecessary toil, and no doubt, as a large proportion are and must be selfish men, in numberless instances they 'scamp' their work in ways the unintelligent never think of. That scamping, together with the eagerness for more money produced by new wants, and a certain indocility or independence, combine to produce an unfavorable impression as to industry which is not justified, or rather is due to other causes than aversion to work. The English must wait a little for full information, the boys who have passed through school not being thirty yet; but they do not despair of seeing plenty of Hugh Millers among their workmen; that is, men who are educated, yet have a definite

love for and pride in exceedingly hard and monotonous manual toil. Miller set up stone walls for eight hours a day, — a real back-breaking occupation, — but he had learned more than most lads. It would be well if half-time could be made general, as many are nearly convinced it would increase learning, by allowing school-time to last longer, and would not discourage any scheme for keeping up the habit of manual labor, which will be the lot of the great majority while the world goes round, and which is, in fact, the permanent gymnasium of the human race; but there is little fear, even if the present system continues. The changes which may come will not be produced by laziness, but by a longing for larger wages, and the comfort they bring, which some industries, agricultural especially, in closely populated countries, may find it difficult to satisfy. It will be satisfied, however, in one way or another, for education opens wide the grand safety-valve, the power of wandering over earth in search of the opportunity of toil. For what we know, the human race may be destined some day to perish like mites on a cheese, through their own multiplication; but at present there is ample space for all of our race, who may for the next century, at the cost only of expatriation, have their twenty acres apiece to work on. Germans, Englishmen, Italians, are swarming out in thousands daily; but still there is no chance that they will perish for want of room, or be driven, like Chinamen, to that ceaseless work for bare existence under which other virtues than industry are apt to perish. Another Europe could live and prosper on the unpeopled river-basins of South America. Education helps to disperse mankind; and we certainly do not find that emigrants, who are rarely of the know-nothing class, are at all reluctant to undertake severe toil. Is there not in the whole discussion a defect caused by tradition, an impression that as brain-workers avoid hard labor, knowing well that they cannot do both up to their full power, those whose brains have been developed will never do it? Fortunately, or unfortunately, they will specially feel the great disciplining force of the world, 'the strong conscription of hunger,' which constrains us all. If all the world were Newtons, nobody would get a mouthful of bread without somebody facing all weathers to plough and sow and reap.

THE IMPERIAL UNIVERSITY OF JAPAN.

To those of us who are not intimately acquainted with the intellectual progress made by Japan in recent years, the calendar of the Imperial university for 1886 will come as a revelation.

It is handsomely printed in the English language, and presents very many points of interest.

We learn from it that the Teikoku Daigaku, or Imperial university, was organized March 1, 1886, by an imperial ordinance. The former Tōkyō university and the college of engineering are merged in the present institution. The university is under the control of the minister of state for education, and depends for its revenue on annual allowances from the treasury of the imperial government. The offices of the university, the library, the colleges of law, medicine, literature, and science, the hospital attached to the college of medicine, and the dormitories of these four colleges, — all the university, in fact, except the college of engineering, which has its temporary location elsewhere, — are situated on extensive grounds near Tōkyō. In the ordinance founding the university, its object is declared to be "the teaching of such arts and sciences as are required for the purposes of the state, and the prosecution of original investigations in such arts and sciences." The president of the university is assisted by a board of councillors, who have charge of the curricula of studies and the promotion of the interests of the university and those of each college. These councillors are selected from the professors by the minister of education, each college being entitled to two. Their term of service is five years. Each college has a director or dean chosen from its professors. The academic year extends, as is usual with us, from September until June, and consists of three terms. Admission to the first-year class is only granted to such students as have completed the course in one of the high middle schools, or can pass an examination instituted by the university authorities. The marking system is in force, and elaborate rules for its regulation are given. There is also a system of elective studies, and a large number of scholarships are provided for deserving and needy students.

In connection with the medical college, a hospital is provided for the admission of such patients as may be deemed instructive cases in medical and surgical practice and investigation. The hospital contains five wards and two hundred and sixteen beds in all. Scientific investigations into the nature of 'kakke,' an endemic disease peculiar to Japan, are carried on here continually. The library — which contains 180,000 volumes — and museums are extensive and well arranged, and there is a special observatory for the study of earthquake phenomena. The general results of these observations are published from time to time in English and Japanese. There is also a botanic garden and a marine biological laboratory.

The university has now 540 students, of whom 183 are law students, 204 medical, 81 in the college of engineering, 23 in the college of literature, and 30 in the college of science. The curriculum is surprisingly comprehensive, and the announcements of courses closely resemble those of a German university. The corps of professors and lecturers includes a number of Europeans and Americans, as well as many natives who have obtained degrees either in this country or in Europe. Among the universities and colleges represented by graduates on the faculty are those of Berlin, Paris, London, Strasburg, Leipzig, Erlangen, Heidelberg, Dublin, Göttingen, Freiberg, Glasgow, St. Andrews, Edinburgh, and Munich in Europe, and Columbia, Yale, Harvard, Johns Hopkins, Michigan, Cornell, Hamilton, Amherst, and Stevens institute in this country.

ALEXANDER'S PROBLEMS OF PHILOSOPHY.

So much of the philosophical writing of the day is either barren repetition or empty rhetoric, that it is something of a surprise to find a book on pure philosophy, written by a man who not only has a definite end in view, but who knows what that end is; and who, to reach that end, has not found it necessary to get together a laborious treatise on the human mind or a huge encyclopaedia of ethical science. In one hundred and seventy pages, Professor Alexander has given us a little work of real timeliness and value. For clearness and profundity of thought, deftness of presentation, and lucidity of style, Professor Alexander's book is not surpassed by any philosophical work of similar scope in the language. We are gratified to miss in it cumbrous terminologies, involved sentences, and inapposite illustrations. It is so simple, frank, and straightforward, that it will appeal to a large class of thoughtful men who are accustomed to sneer at philosophy and its devotees.

The various chapters are themselves so tersely worded, that any summary of them that would be just and at the same time much shorter than the chapters themselves, is impossible.

The opening chapter, 'The difficulties of philosophy,' strikes the keynote of the book. The author shows that many so-called philosophical difficulties are not difficulties at all, but simple fictions, originated by ignorant or superficial persons, who set them forth 'as lightly as they tell an after-dinner story.' Professor Alexander very justly refuses to spend his time in criticising such

Some problems of philosophy. By ARCHIBALD ALEXANDER, Ph.D. New York, Scribner. 16°.

views, and remarks that "a man who has not learned the alphabet is usually deficient in a knowledge of grammar. A surgeon who does not know anatomy is not likely to inspire confidence. The philosophical dilettante who plunges into the solution of problems of great importance without scientific preparation may be left to the task of 'drawing out leviathan with a hook,' and one need not be disturbed if his unsuccessful efforts lead him to the conclusion that 'metaphysics' is obscure, useless, and irreligious." The author then takes up the three ways of viewing metaphysical questions, — the sceptical, the dogmatic, and the critical, — describes each, and implicitly accepts for himself the latter method and the stand-point of Kant. In fact, Professor Alexander's thought is interesting as illustrating a 'return to Kant' which does not necessarily imply a return to Hegel.

In the seventeen brief chapters which follow, the author formulates according to the critical method some of the most important philosophical difficulties as they appear to him. He does not do this with the intention of prejudicing any particular answer to each, but rather, we suspect, to show that "a year's study of a text-book of mental philosophy is *not* all that is necessary to put a man *en rapport* with the state of thought in the present." Professor Alexander's use of the formal logic is excellent, and serves to show what a formidable weapon that much-decried science may become in the hands of an experienced craftsman. In no instance, although disjunctions, dilemmas, syllogisms, and enthymemes occur on almost every page, have we come upon any logical slip or fallacy, though unquestionably specific points in the various arguments may be disputed on psychological or metaphysical grounds.

As an example of the author's method, we quote the conclusion (p. 38) of his chapter on 'The problem of the ultimate nature of matter:' "It is impossible, so far as we know, to separate the fact of force and the fact of causality. One is not found without the other. Wherever there is an effect, there is a manifestation of force. Wherever there is a cause, there is an exercise of force. When, therefore, we attempt to explain matter by referring to force, we are obliged to explain force by referring to causality; and in explaining causality we cannot refer to material phenomena, but are obliged to fall back on the *a priori* law of causality, which is not given by experience."

On the question of the place of physiological psychology, the author speaks plainly, and, it seems to us, with sound common sense. He remarks (p. 63) that "there are two common mistakes, — one, the denunciation of physiological

methods by men who have never seen a ganglion-cell; the other, the denunciation of subjective methods by men who have never given an hour to introspection. It does not appear to be necessary, however, that a knowledge of one set of facts should be incompatible with knowledge of the other set. A combination of the two is the ideal psychology."

It is interesting to find Professor Alexander proving (pp. 64, 65) that "it is possible that it is rational to accept what is irrational because it is more rational to trust the authority for what is thought to be irrational than to place our own reason above such an authority." The admission of this conclusion into the arena of scientific debate would be an effectual blow to those self-sufficient investigators who find as many criteria of truth as there are minds.

We should be glad to point out several other portions of this book that we conceive to be the most interesting, but lack of space forbids this. On the argument by which the author tries to show the atheistic meaning of pantheism (p. 121), however, two points of possible criticism suggest themselves. In showing, that, if a plurality of principles is admitted, pantheism, which admits but one principle, falls, Professor Alexander says, "The existence of human persons with conflicting purposes cannot be explained without asserting (on the pantheistic hypothesis, of course) that there is opposition between the parts of God, i.e., a plurality of principles." Would not the same argument prove that the human *ego* is plural? For we certainly find conflicting motives and principles in our own minds. Again, may not the opposition spoken of be only apparent, and the result of our insufficient insight or lack of knowledge? May it not be a part of a real and higher harmony of which our limited faculties are not cognizant?

At the conclusion of the same argument (p. 122), Professor Alexander, having already shown, that, if the pantheistic God is either material or ideal, atheism is the logical consequence, adds, "If the universe, i.e., God, is both material and ideal, then, in so far as God is material, the objection urged as to materialistic pantheism is applicable; and in so far as God is ideal, the objection urged against idealistic pantheism is applicable." Is this treatment by partition valid? Is it possible to separate a compound, and reason about its various constituents as separate entities or qualities, and not as parts of another and more complex whole? It seems to us not. We cannot say that water, in so far as it is oxygen, will do thus and so, and, in so far as it is hydrogen, will do something else. Water is a new compound, and it develops new properties as water, which are not

represented by adding together the properties of oxygen and hydrogen. Suppose, then, that the assumed combination of material and ideal in God give a new set of properties: are they given recognition in this treatment by partition? We are not impugning in any way Professor Alexander's conclusion, but simply stating some objections that have occurred to us as to his method of reaching it.

The concluding chapter, on the 'Doctrine of cause and effect,' is both the longest and most finished in the book. It is a concise and admirable summary of the historical aspect of the doctrine of causation from the pre-Socratic philosophers to Mill and Spencer, and a profoundly suggestive indication of the true theory of cause and effect. All of Professor Alexander's work is thoroughly well done, and we regret to see that not a few typographical errors have crept into an otherwise model piece of book-making. We trust that the book will have a wide circulation, for it will be found an excellent mental tonic as well as an emphatic protest against the philosophical dilettantism now so current. N. M. B.

A NEW EDITION OF JUVENAL.

AN edition of Juvenal that should be sufficiently practical for the college class-room, while embodying the latest results of classical research and criticism, has for several years been greatly needed. It is therefore with interest that one turns to the present work in the hope of finding a happy medium between the too fine-spun commentary of Simcox and the too rudimentary treatment adopted by Hardy.

Apart from the typography, the book is a disappointment. The notes contain nothing whatever that is new, being too evidently condensed and simplified from Mayor, and are so desultory and ill-assorted as not even to deserve credit for judicious selection and arrangement. Moreover, real difficulties, both of syntax and exegesis, are passed over, while an inordinate amount of space is given to the elucidation of matters that ought to be familiar to any intelligent school-boy. How meagre are the grammatical notes, may be seen from the fact that on the 171 lines of the first satire there are but two; on the 322 lines of the seventh, with its fourteen pages of commentary, there are but two; and on the 365 lines of the tenth there is only one. When the editors do venture to elucidate some syntactical peculiarity, it is always one that would seem to need no com-

ment whatsoever: as, for instance, the vivid use of the imperfect subjunctive in vii. 69, 70; or the by no means extraordinary employment of the indicative in x. 123; while peculiarities like the metrical *quis* in xii. 48, and the implied *ut* from *ne* in xvi. 9, are still untouched. But, on the other hand, there is a superabundance of commentary like the following on xvi. 14:— "*Grandes magna ad subsellia*: the bench had to be ponderous to support its huge occupant."

An important feature of this edition is the professedly idiomatic translations sprinkled through every page. These are not intended to be paraphrases, for they are enclosed in quotation-marks; and, besides, a paraphrase is elsewhere prefixed to each satire. One instance of this extraordinary rendering will probably suffice. Satire vii. 36 is *translated*, "Now hear the rich man's tricks. To avoid subscribing to you, he poses as a fellow-poet, and trusts to the maxim that 'dog does not eat dog.'"

The editors have very commendably refrained from the absurd expurgation that disfigures so many college editions of Juvenal. Excessive expurgation only excites prurient curiosity; while it so emasculates the author as to make it quite impossible for the reader to claim any real acquaintance with Juvenal as he is, or to understand the bitterness and the motive of his *saeva indignatio*, from the perusal of these fragments of the scattered poet.

The introductions, the summary of a paper by Professor Nettleship, and a brief account of the Codex Pithoeanus, are interesting; but why discuss the Codex Pithoeanus in a work of so elementary a character as this last edition of Rome's greatest satirist? H. T. PECK.

EDWARDS'S DIFFERENTIAL CALCULUS.

A NEW text-book on the differential calculus comes from the press of Macmillan & Co. It resembles, in size and appearance, the well-known works of Todhunter and Williamson. An exceedingly satisfactory introductory treatment is secured by a close adherence to one point of view, that of limiting ratios. The symbols *dy* and *dx* are not used apart, nor the meaning of such a use explained, until the formulas of partial differentiation in chapter vi. prevent any further postponement. In this way, however, there is lost the advantage of exhibiting the variety of original conception and breadth of foundation distinguishing this branch of mathematics, — an advantage,

Differential calculus, with applications and numerous examples. By JOSEPH EDWARDS, M.A. New York, Macmillan. 8°.

Thirteen satires of Juvenal: with introduction and notes. By C. H. PEARSON, M.A., and HERBERT A. STRONG, M.A., LL.D. Oxford, Clarendon pr. 12°.

indeed, much more frequently sought than obtained. The language is plain, and the geometrical illustrations are numerous and good. The serious faults of the book are sins of omission. We look in vain for the customary chapter on the change of the independent variable, and we find a strange limitation in the treatment of the important subject, 'maxima and minima.' The author here contents himself with the discussion of functions of a single variable. The use of symbolic methods, involving the extension of the mathematical laws for the combination of quantity to the symbols of operation, is necessary in the modern differential calculus. In this work the principle introduced is explained in an excellent manner, but a fuller exemplification of its legitimate outgrowth is desirable. More illustrations should be given, especially of the symbolic method of extending Taylor's formula to several variables. The chief strength of the book lies in the chapters relating to the theory of plane curves. In not a few cases we find greater detail and thoroughness than in the corresponding chapters of its predecessors. On the whole, while no decided novelty of treatment is shown to those acquainted with the best works hitherto published, the production is a creditable, useful treatise, without other faults than those mentioned above.

THOMAS S. FISKE.

THE ALKALI LANDS OF CALIFORNIA.

THE term 'alkali soil' is used in California, and the western states generally, to denote any soil which contains an unusual amount of soluble salts, particularly when they render their presence manifest by an efflorescence on the surface. These salts may be simply an excessive amount of the neutral salts found in minute amounts in all soils, or, in those soils more properly designated as alkaline, they may consist in part of carbonate of soda.

By the natural processes of evaporation at the surface and capillary rise from below, these salts tend to accumulate near or at the surface, thus producing the efflorescence above noted, and also destroying or injuring the crop by their corrosive action on the root-crown.

In the actually alkaline soils, i.e., in those containing carbonate of soda, another injurious effect is also observed. The alkali prevents what is known as the 'flocculation' of the clay contained in the soil; that is, it keeps in the finely divided condition seen in 'puddled' clay. Such a soil can

never be brought into proper tilth; even the most thorough cultivation only succeeds in breaking it up into larger or smaller clods, and leaves it in a condition entirely unsuited for the growth of crops.

These alkali soils are somewhat abundant in California, notably in the otherwise extremely fertile San Joaquin valley; and the characteristics outlined above have been tolerably familiar for years. It was not, however, until it was discovered that the process of irrigation, so essential in the dry climate of that region, was serving to extend the area of these alkali soils, and even developing them where they did not exist before, that the magnitude of the problem which they present was generally appreciated.

The pamphlet under review is a summary of investigations carried out at different times at the College of agriculture of the University of California, and in connection with the U. S. census of 1880 by Prof. E. W. Hilgard, than whom there is probably no one more eminently qualified to deal with the question scientifically and practically.

According to Professor Hilgard, the immediate source of the alkali is usually to be found in the soil-water, though it would appear, that, in some cases at least, the lower strata of the soil itself may contain either these salts or compounds which readily yield them by weathering. When reached by digging, the soil-water is not necessarily perceptibly salty or alkaline; but as it evaporates at the surface, and is supplied from below, the soluble salts are concentrated in a very shallow layer at the surface, the solution becoming strong enough to kill crops, or even depositing the solid 'alkali.'

It is thus evident that the most important factor in determining the amount of alkali which accumulates at or near the surface of the soil is the amount of soil-water brought up from below by capillary action and evaporated; and any thing which increases the evaporation will tend to increase the amount of 'alkali' deposited, and to make its presence perceptible in spots where before it was not present, or present in such minute amounts as to produce no harmful effects. This, irrigation, as ordinarily practised, does. If the irrigation-water is used somewhat sparingly, so that it all finally evaporates from the surface, two effects follow: first, the greater amount of water passing first downward, and then upward through the upper strata of the soil, tends to exhaust it more thoroughly of its alkali, concentrating all of it at the surface; second, by irrigation the soil is moistened to a greater depth than it was by the rainfall only, and thus a greater amount

of soil is exposed to this leaching action, and more alkali put in circulation, particularly if these lower strata are rich in alkali or materials yielding it.

If, on the other hand, the water is used lavishly but without proper provisions for drainage, evil effects are produced in a somewhat different way. In this case the level of the hydrostatic water of the soil (its water-table) is brought nearer the surface. The water has a less distance to rise by capillary action, hence rises more abundantly and for a longer time, and an accumulation of alkali is brought about. In one or other of these ways is brought about the phenomenon well described in local nomenclature as the 'rise of the alkali,'—a thing which is threatening most serious injury to the irrigated lands of the San Joaquin valley.

All these and other points are brought out most plainly in detail in the report before us. One interesting point deserves special mention. Analysis shows that the alkali of these soils is in many cases rich in plant-food, often containing phosphates and potash salts in practically inexhaustible quantities, and not infrequently considerable amounts of nitrates; and that, if its excessive accumulation can be prevented, the soils containing it will prove extremely fertile.

The question of remedies is fully considered. When irrigation is practised, the prime condition of success is a thorough system of drainage, combined with an occasional flooding with a large quantity of water, in order to wash out the soluble alkali into the drainage in case the rains of the rainy season do not accomplish this sufficiently. Drainage may, further, so lower the water-table as to greatly diminish the amount of water rising through the soil, while the roots of plants can readily penetrate to considerable depths for a supply of water. The author is very emphatic in his statements that irrigation without provision for drainage is suicidal.

Second in importance to drainage, is thorough cultivation of the surface in order to diminish evaporation. Mulching has a similar effect. This necessitates, however, the cultivation of crops admitting of tillage. Hitherto wheat has been the staple crop of the region under discussion, regarding which Professor Hilgard remarks that "it would really seem as if, in the broadcast culture of cereals, the farmers in the alkali districts had made the worst possible selection for the permanent good of agriculture in their region." As crops suited for alkali soils, he suggests alfalfa (a deep-rooting crop, which shades the ground and thus diminishes very largely surface-evaporation) for a forage-crop, and also roots, where these can be utilized for feeding purposes. As crops for

sale, he suggests, first, cotton; then the castor-bean; further, fruits, especially raisins and prunes; and possibly sugar-cane and sorghum.

As supplementary to drainage and tillage, certain chemical antidotes may be employed. Land containing carbonate of soda is greatly benefited by gypsum; a double decomposition yielding, in the presence of water, carbonate of lime and sulphate of soda, both relatively innocuous as compared with carbonate of soda. Soluble earthy and metallic sulphates and chlorides may be precipitated by lime, or sometimes by calcareous marl even.

It is evident, however, that these chemical antidotes only change the nature of the alkali, but do not remove it from the soil. Indeed, they tend rather to add to the amount of easily soluble matters in the soil, and, when the amount of alkali is at all large, are to be looked upon simply as adjuncts to the measures before mentioned.

Thus far the irrigation-water itself has been tacitly assumed to be pure. In fact, however, this is by no means the case; and a most important part of Professor Hilgard's work upon this matter has been his examinations of the water available for irrigation. The water of Tulare Lake, for example,—one of the large bodies of water that had been counted on for purposes of irrigation,—was found to contain so much alkali, especially carbonate of soda, as to render it unfit for irrigation. Kern Lake and Buena Vista Lake were found to be even more alkaline than Tulare Lake. These waters, *when concentrated in the soil by evaporation*, must rapidly increase its content of alkali, and prove fatal to all cultivated crops. Even the purer waters of the rivers were found to contain more or less alkali; and in regard to them all, the necessity of combining drainage with irrigation is to be emphasized.

A most interesting and instructive appendix to Professor Hilgard's report is constituted by the report of the '*reh* committee' for the Aligarh district, northern India, *reh* being the Hindoostanee equivalent of 'alkali.' From this it appears, that, in the irrigated districts of northern India, the same phenomena have been observed as are now developing themselves in California; and the government is now confronted with the necessity of carrying out difficult and costly remedies, or apparently of abandoning altogether or in large part its system of irrigation. In regard to the question of remedies, the Indian committee is substantially at one with Professor Hilgard, making due allowance for the fact that in India the question is one of remedying an existing evil, while in California it is as yet largely one of prevention.